The

Electrical Review

VOL. CII. JANUARY 6, 1928. No. 2,615.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

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Telegraphic Address: "AGEEKAY, CENT., LONDON," Code, A B C. Telephone No.: Central 7672 (Three Lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 6d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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Materials for the Electrical Industry.

IN the copper market the year 1927 has been an interesting one in that it represented the first calendar year's operations on the part of Copper Exporters, Incorporated, which concern was launched towards the close of 1926. This organisation controls the sale of the bulk of the world's output, excluding sales made in the United States. Its avowed object was to "stabilise" prices, but as can be judged from the fact that electro stood at about £66 15s. 0d. when the concern started to function in October, fell by two or three pounds by the end of 1926, dropped further to £59 15s. 0d. later on, and at the end of 1927 stood at £66 15s. 0d. it would not appear as if its object had been accomplished. Of course, regard has to be had for the fact that the price might have fallen to a much greater extent had the Incorporated Exporters not been in existence.

The consumption in the United States was not up to the level of 1926, the average monthly deliveries for January/November, 1927, equalling about 69,450 tons (of 2,000 lb.) against an average of 75,000 tons in the year 1926, and this appeared to induce a generally cautious attitude on the part of buyers, who refrained from placing orders for more than their most urgent needs, and prices declined. On the whole, however, the situation has not deteriorated much, for although, as indicated, the deliveries to American consumers declined, those for export showed an increase. The average per month in 1926 was about 43,800 tons (of 2,000 lb.), whereas in January/November of 1927 the average was 52,500 tons. The refined stocks of copper in America, however, increased from 85,500 short tons at the end of 1926 to 90,800 tons at the end of November last. During the latter part of last year a much improved demand developed from Europe generally and a good business was done. Producers having sold

so well no doubt will be less anxious to cut prices than they were. Besides, the Copper Exporters, Incorporated, now have but little outside competition to contend with. The prospects for 1928 would seem fairly favourable for a steady market if the development of industrial affairs in America should permit of an increased consumption there to offset any decrease in Europe's takings.

During last year lead values dropped considerably, which must be ascribed to the simple fact that supplies appreciably overtopped consumption. During the previous few years, high prices prevailed for this metal, and this had the inevitable effect of stimulating output, as is evidenced by the fact that the world's output, which in 1922 was 1,069,767 metric tons, increased to 1,595,360 tons in 1926. This expansion was not noticeable so long as consumption was on a level high enough to absorb the metal, but during last year the consumption did not make a good showing, the cable trade taking appreciably less metal, with the consequence that stocks commenced to accumulate. Lately the demand on the Continent has been considerably better and conditions in this country have improved. At the moment the outlook seems to be viewed with rather more confidence, but unless there is going to be a good increase in consumption or a curtailment in production in 1928, there does not seem much reason for a material increase in the price.

The year was not a particularly auspicious one in the spelter market so far as prices are concerned. At the end of 1926 the price was £32 15s. 0d., whilst on December 30th last it was £26 5s. 0d. To some extent this may perhaps be attributed to the decline in lead, there being generally a similar tendency in the prices of these two metals. It would also appear to be due, however, to a slower rate in industrial conditions in the United States which induced lower price conditions there, and a sympathetic movement here. In addition to that, business in galvanised sheets here has been poor owing to the congested state of the Indian market for that commodity. As a result the demand for spelter in this country has been slow. The foregoing remarks apply to ordinary grades. In the case of 99.9 per cent. high grade, conditions lately have been different, a very good demand for this having developed, mainly on the Continent. In view of the tendency towards increase in the world's plant capacity for the production of high grade metal, one can hardly visualise any actual scarcity developing in this grade. As regards the general outlook for the coming year, values can hardly improve much till the galvanised sheet business is better, but they might quite well do so then, and meantime it is noticeable that at round about £26 or a little less, values show resistance to further declines.

The rubber market during the past year has pursued a much steadier course than was the case in 1925 and 1926. At the beginning of 1927 the exportable quota from the restriction area was 80 per cent. of standard, but this was reduced to 70 per cent. at the end of January and to the existing 60 per cent. at the end of the following quarter. Stocks increased both here and in the United States during the greater part of the year, but prices moved within narrow limits, which served to keep the market singularly free from speculation. The lowest levels of the year were reached in the autumn, after which a turn for the better was seen, partly owing to the official notification that assessments of standard production under the restriction scheme would be revised. This revision has resulted in an average reduction of something like 15 per cent. The gradual clearing up of the unused rubber coupons also paved the way for better conditions in the closing months of the year, when both America and the Continent proved good buyers. The outlook for 1928 is regarded with quiet optimism, for although the heavy stocks and general position are not particularly encouraging, the general lowering of the assessments of estates and the prospects of a larger output of motor cars in the United States are likely to outweigh the adverse factors.

Electricity Supply at Exhibitions.

A CORRESPONDENT in this issue draws attention to the exorbitant price charged for electricity for heating and power at Olympia during the run of an exhibition, in spite of the fact that the building is supplied with electrical energy at very low rates. Unfortunately, this evil practice is not confined to Olympia—it is met with at the Agricultural Hall, and possibly also elsewhere. That it is short-sighted and mischievous is (or should be) obvious, even to those who organise the show and reap the profits—for there is nothing more attractive than a machine or process in actual operation, and surely the promoters are directly interested in the "draw" of an exhibition, which is reflected in the drawings. But these are minor considerations, as they affect only a few persons—vastly more important is the loss of business to exhibitors and the resulting lack of employment for our workpeople, due to the omission to demonstrate the successful operation of an exhibit and to bring out its best selling points. Exhibition promoters, like electricity supply authorities, owe a duty to the public as well as to themselves, and they ought to offer electrical power and heating at the lowest possible price, in order to stimulate and encourage the display of working machines. We hope that they will take a common-sense view of the matter and do their utmost to develop the use of electricity by exhibitors.

Industrial Lighting Statistics.

IT is common knowledge that there has been widespread improvement in industrial lighting during recent years. Nevertheless, the informative paper recently read by Mr. J. L. H. Cooper before the Illuminating Engineering Society, which is abstracted elsewhere in this issue, shows that there is still great need for improvement. At first sight the main conclusions of his statistical survey will seem to be inconsistent: the majority of factory managers profess to believe in good lighting, yet only 10 per cent. of the works visited could be considered really well lighted, and 40 per cent. were classed as poor; 70 per cent. of the factories used gasfilled lamps exclusively, which is evidence of enterprise, but in many cases that type of lamp was not wisely used, and the advantages of internally-frosted, white-sprayed, and opal lamps in diminishing "glare" were rarely appreciated. This seems to show that, whilst the education of factory managers in lighting matters has proceeded up to a certain point, more instruction in *principles* is needed. The Illuminating Engineering Society has done good service by making these facts known, and it is largely through its efforts that the fundamental principles of good lighting are being spread. Mr. Werner (H.M. Chief Superintending Inspector for the Midland Division), in opening the discussion, paid a tribute to the value of the work of the Society, and made a most useful contribution to the discussion. The study of recent reports of H.M. Chief Inspector of Factories shows how keen an interest is being taken by factory inspectors in factory lighting, and the lighting industry should gratefully recognise the really excellent educational work that the Home Office Factory Department has done in this field.

Electricity the Sailor's Friend.

FOR many centuries magnetism alone of the twin sciences was the sailor's guide; nowadays its sister electricity has claimed her share in his service, and by radio-telegraphy, directional wireless, echo sounding, and the gyroscopic compass has immensely improved his lot. But her earliest achievement was the provision of a powerful and penetrating beam for the lighthouse, and it is interesting to note, in connection with the up-to-date equipment described on following pages, that the original alternators which were installed at the Lizard nearly half a century ago are retained in use. Credit is due to those pioneers who built them so well that they are still judged worthy of fulfilling so important a function.

Modern Lighthouse Installations.

Several of the Trinity House lighthouses have been or are being equipped with high-c.p. metal-filament lamps with automatic control and alternative lighting.

THE use by Trinity House of gasfilled incandescent electric lamps for the navigational lights in lighthouses and lightships round the coast of Great Britain is in some respects the greatest achievement yet to the credit of illuminating engineering.

It is a far cry from the beacons that once lit our cliffs, forming a rough and ready indication of danger to mariners, to the modern lighthouse, with its intricate optical system and automatic electrical equipment, and it has been only by gradual development and improvement of the lighting apparatus and illuminating source that lights such as those in the Lizard and Eddystone Lighthouses, which are equipped with the means of flashing signals of definite characters, have been evolved.

For the early electric lighting, dating back to 1860 or earlier, the source of the illuminant took the form of carbon arc lamps fed by special electric generators, and both the lamps and the generators needed continual supervision. Three or four years ago, however, the General Electric Co., Ltd., was asked by the engineer-in-chief of Trinity House whether it could produce high-power gasfilled lamps which could be used in place of the existing arc lamps. Experimental work was immediately started, the principal problem being to produce a filament which would maintain the beam as far as possible at its full brightness while it was visible, and then give place to absolute darkness, at the same time giving a compact focal source in order to avoid a split beam. After many months of experimenting this difficulty was surmounted and a suitable disposition found.

The Osram lamps now employed in the lighthouse service are by far the largest to be found anywhere in daily use and range up to 4 kW loading. The filaments operate at 80 V, and therefore the lead-in wires have to carry 50 A and be of 1/20th sq. inch cross-sectional area. The solution of the problem of making a vacuum-tight seal between glass and wire of such thickness demanded over a year's research work.

The introduction of these high-power electric lamps rendered the lighting itself capable of being run practically without attention, but the failure of a lamp or of the current supply was a contingency to which careful consideration had to be given. Trinity House overcame this difficulty, however, by introducing two lamps and a stand-by emergency acetylene light, each capable of replacing the other, as it was considered that while the possibility of two lamps failing in one night was remote, should this occur, or the electric current fail, there was still the acetylene light to fall back on.

As the source of illumination must occupy a definite focal position of the lenses, it is necessary, in the event of the failure of the lamp filament, to remove entirely the faulty lamp and bring another lamp into the same position. After studying various methods it was found that the best means of doing this was by use of a turn-table on which are mounted two electric lamps and the emergency acetylene burner, figs. 3 and 4. Incorporated with the turn-table are such accessories as contactors and switchgear for discriminating purposes. By virtue of the fact that the electricity supply is cut off previous to the starting-up of the equipment, this being equivalent to failure of the supply, it will be realised that the acetylene burner is initially in the focal position. In attended lighthouses the procedure is to light the by-pass of the acetylene burner, and close the main switch; then, if the electricity supply is in order and one or both lamps intact, the turn-table will automatically rotate, bringing the lamp into the focal position and, at the same time, extinguishing the acetylene burner. In unattended lighthouses the by-pass of the acetylene burner is continuously alight, and the switching-on of the current and gas supply is controlled by a time switch. Should one electric lamp fail, the other is automatically brought into focus by the automatic rotation of the turn-table, but should the current or both lamps fail, the acetylene burner swings into focus and supplies the necessary light.

Several installations have already been completed, including the famous lighthouses of Pendeen, Lizard, Hartland, Burnham and Skerries, while others are under consideration.

The Burnham installation, shown in the accompany-

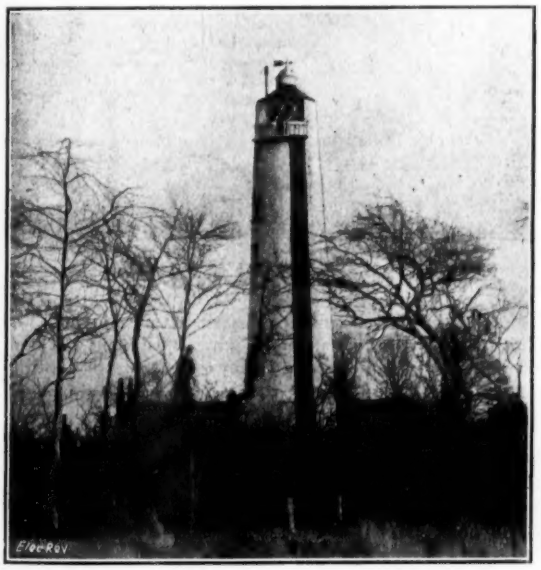


Fig. 1.—Burnham High-Light Lighthouse.

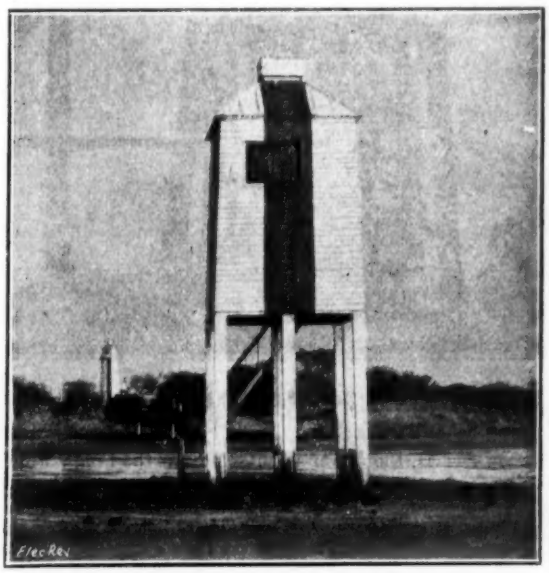


Fig. 2.—Burnham Low-Light Lighthouse.

ing illustrations, consists of two complete equipments situated approximately a quarter of a mile apart. The flashing signals are produced by switching *on* and *off* the electric lamps, and, although the lights are so far apart, the flashing characteristics are synchronised and controlled by a master flasher in the main lighthouse.

In developing this particular equipment another problem had to be faced, for during the dark period, between flashes, the power is cut off from the lamp, which is equivalent to a supply failure. Arrangements had to be made so that the turn-table did not move during this period. It *does* move, however, should the lamp become faulty during either a dark or light period, or if any breakdown in the local supply occurs.

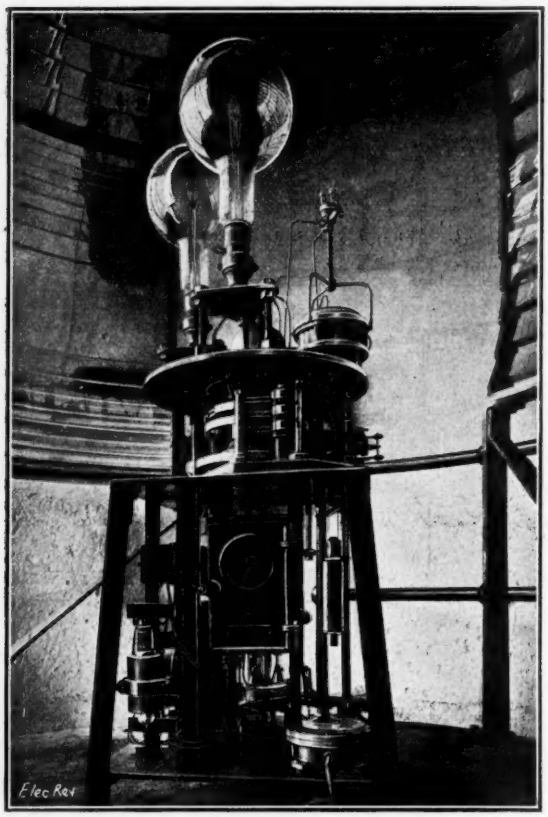


Fig. 3.—Automatic Control and Lamps in the High Light.

Figs. 1 and 2 show the Burnham high-light and low-light lighthouses respectively.

Complete conversion of the existing plant was necessary at the Lizard Lighthouse. The original light was an arc lamp working at approximately 30 volts, and the source of power was one of two French alternators, between 40 and 50 years old. Owing to their design these machines did not appear to be very promising for supplying metal-filament lamps, but as they were otherwise sound the authorities would not consider replacing them with more modern generators. Transformers, however, were introduced and other adjustments made, after which a satisfactory output was obtained. The whole of the lighting equipment has been made automatic, and in addition an automatic winding device has been added to the clock which rotates the lenses.

Fig. 4.—Low-Light Lamps and Controlling Gear.

The above installations were provided and fitted by the General Electric Co., Ltd., and have proved, it is claimed, that automatic control of lighting apparatus, including metal-filament electric lamps, can safely be employed to give reliable and economic results.

Electrometric Equipment.

A review of some recent developments in electrical apparatus for the control of various industrial operations and processes in the United States.

ONE of the greatest problems of industrial management at the present time is the scientific control of the various operations in manufacturing industries. Recent progress in electrometric control has been greatly facilitated by improved designs of electrodes and cells, especially in apparatus used for measuring surface-condenser leakage in power plant.

The latest types of electrodes consist of brass rods capped with gold and moulded with bakelite into brass tubes. The whole may be inserted through a gate valve, making a very strong and convenient cell suitable for neutral or weak acid solutions. The use of bakelite renders the cell able to withstand high pressures—up to 300 lb.—without the use of packing glands or cements. The gold caps are platinised and then sand-blasted to drive the platinum back into the gold, so forming a surface on which polarisation effect is negligible. The prompt detection of leakage by conductivity instruments operating with alarm contacts has eliminated the expense of cleaning boilers which otherwise would have been salted up. Fig. 1 shows a removable-type conductivity cell.

The hydrogen-ion control of boiler feed water is a recent interesting development, and an example of automatic control of this kind is to be found in the power station of the Public Service Gas and Electric Company, at Perth Amboy, New Jersey, U.S.A., where the system is used to regulate the addition of caustic soda and sodium phosphate to the boiler feed water, and to keep the latter at constant ionisation. By this means greater uniformity in alkalinity is ensured, and there is consequently less trouble from blow-downs. There is also less condenser-leakage effect, as additional chemicals

are added automatically to compensate for the leakage. Another very ingenious form of H-ion control is the time-lag proportional-step type of apparatus, in which the recorder works in two cycles—recording and controlling—the timing of which may be easily changed to meet the conditions of any given problem. During the required period a record of the H-ion concentration is made. When the effect of the last operation of the motor-driven valve is registered, the control cycle begins and an auxiliary e.m.f., equal to the e.m.f. of the electrodes when the concentration is at the desired value, is introduced, causing the recording carriage to immediately move towards the control point, when the valve starts working in such a direction as to adjust the concentration to the value required. Since the position of the valve never deviates much from that required to ensure the correct quantity of chemicals, this form of control is applicable, even in those cases where no equalising tank is available, where there is a considerable change in the flow. The proper setting of the control point is determined from the daily alkalinity analysis of the boiler water, thus largely eliminating errors due to inequalities in the tungsten electrodes, so that the latter may be used safely for over six weeks, practically free from drift. Fig. 2 shows a recorder controller and automatic valve used in boiler-feed-water control.

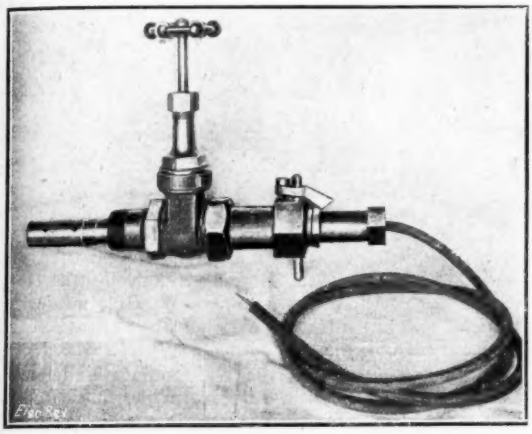


Fig. 1.—Removable Conductivity Cell.

In the acid treament of zeolite-softened water sulphuric acid is added to reduce boiler alkalinities which may become much too high, and to maintain a correct sulphate-caustic ratio. In such cases the flow-type quinhydrone electrode may be successfully used.

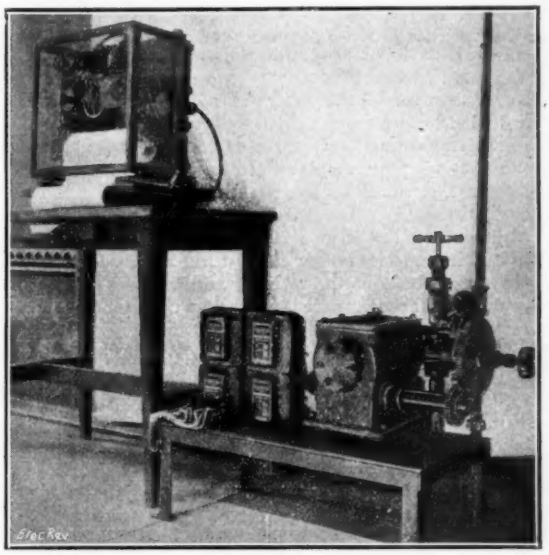


Fig. 2.—Feed-water Recorder-Controller and Automatic Valve.

Although automatic control should be possible, the recorder readings at present are used as a guide for the proper setting of the flow-proportioning device, more acid being added if the alkalinity of the untreated water increases; the ratio thus maintained is fairly constant, it being assumed that accurate control of the boiler blow-down has been maintained by conductivity measurements.

In some cases the alkalinity has been found practically proportional to the conductivity, although the measurements cannot, of course, distinguish between accumulation of salts and alkalinity. The hydroxyl-ion has approximately twice the mobility of any other ion in such a mixture, so that the conductivity measurements in most cases are found to be closely related to alkalinity. When the salts and causticity are kept in definite ratio, as they should be, it is clear that conductivity will indicate total concentration.

Measuring the conductivity of boiler water with a portable instrument, calibrated in conductance units, is

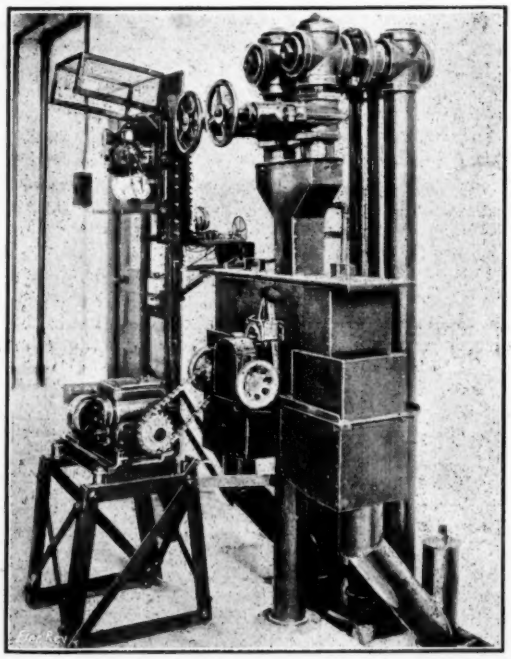


Fig. 3.—Sewage Disposal Control Apparatus.

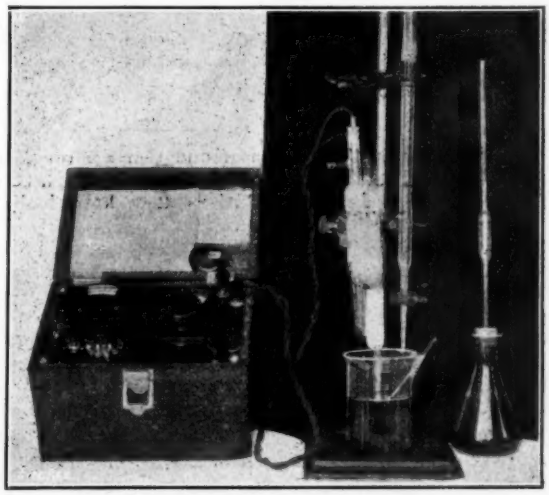


Fig. 4.—Quinhydrone Electrode Control Outfit.

considerably easier than analysis by titration. The ideal method would be to place a cell inside the boiler, but this is impracticable for high-pressure boilers.

Another interesting field for electrometric control is to be found in sewage disposal, where the direct oxidation method is used. Here, again, the time-lag proportional-step type is used, including a milk-of-lime dosing device consisting of a short flume with a weir at each end. One end of the flume serves as an overflow return, while the chemical feed flows over the weir at the other end. The flume is tilted automatically to supply more or less lime to the sewage. Other features include a flowmeter with a device for ensuring that the chemical feed increases or decreases proportionally to the rate of flow, working on the follow-up principle. The H-ion control serves to correct this rough adjustment in order to give the solution a constant concentration. It is, however, desirable to keep the effluent at a fairly high causticity, and this means in practice a slow drift of the electrodes to higher voltages. It is better to use two electrodes in parallel, changing one electrode every day and using them in rotation, and keeping them in saturated sodium-phosphate solution when not in use. Fig. 3 shows a recorder-controller and tilting lime feed apparatus used in sewage disposal.

In the manufacture of sugar, both of the cane and beet varieties, the importance of careful control of the various operations at every step cannot be over-rated, and one of the most important applications of electrometric control is in the second carbonation of the sugar. By means of H-ion records obtained with the

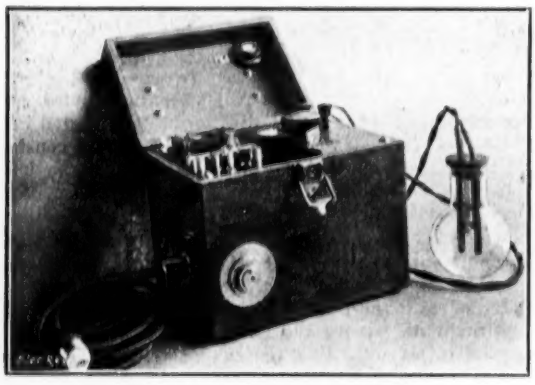


Fig. 5.—"Sugar-Ash" Bridge.

tungsten electrode considerable improvement has been obtained by using the recorder chart to determine the proper setting of the valve. Tungsten electrodes, together with the tilting-weir box, are being used in Porto Rico, having the time-lag proportional-step type of automatic control. It was found that the tungsten electrodes indicated correctly the changes in H-ion concentration, but in some solutions they have had a slightly different pH voltage from that of buffer solutions. The readings of the tungsten electrode are checked against a quinhydrone electrode, and if there is a discrepancy in the readings the pen is adjusted to give the correct value. The dip-type quinhydrone electrode, with portable potentiometer, fig. 4, is now being used by several sugar companies in Cuba and elsewhere, frequently in conjunction with the flow-type tungsten electrode. In controlling the lime addition for defecation the solution is cooled to about 60 deg. C. by flowing it through the cooling coil; it then passes the tungsten electrodes and calomel cell. Automatic temperature compensation is provided, together with valves for draining the cooling coil and for blowing live steam through the apparatus for cleaning and sterilising it. Many sugar companies are also using the conductivity method for the determination of sugar ash, for which purpose a new bridge, fig. 5, reading directly in specific conductance, and having suitable temperature compensation, has been designed. With such an outfit the most unskilled and inexperienced labourer may make sugar-ash determinations.

In a paper read by Mr. Harold C. Weber before the American Institute of Chemical Engineers, abstracted in *Chemical and Metallurgical Engineering*, some suggestions are made as to the use of vacuum tubes in the control of processes. The three-electrode vacuum tube is being used for the analysis of gases; for the measurement of gas velocities that are lower than can be measured successfully with the pitot tube; for the measurement of pressures, particularly those that are high and suddenly developed as in explosions; for the determination of certain characteristics of material such as dielectric constant and electrical resistivity; and so on. One cable company is using the vacuum-tube oscillator to follow the changes in rubber during vulcanisation, and a Boston manufacturer has apparatus available for controlling the thickness of coating materials.

It has been found that the vacuum tube may be very successfully used for the measurement of the small e.m.f.'s set up in electrometric titrations and by thermo-couples used for the measurement of temperatures. In all cases of voltage measurement the vacuum tube offers the advantage that the current taken by the input circuit of the tube may be made as small as desired. This is a distinct advantage for most work as the effects of line resistance and polarisation are eliminated.

Oscillating circuits offer several methods of determining pressures. A device similar to that indicated for the analysis of gases will serve as a pressure gauge, since the change of dielectric constant with pressure will cause a change in frequency in the oscillating circuit and this in turn may be calibrated in terms of pressure. A second method of pressure measurement consists in making the condenser serve as a compression member, so that the applied pressure varies the distance between the two plates and in this way causes a change in the frequency of the currents being generated. An English experimenter, working with such a device, has been able to detect the bending of an oak table top an inch and a half thick when subjected to the load of one penny.

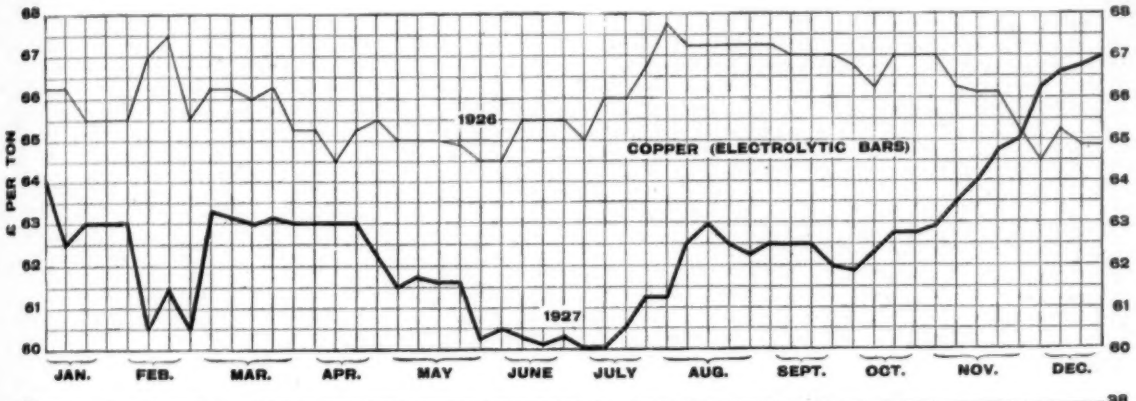
Some device for the measurement of small pressure differences is needed, especially in connection with pitot tubes and venturi meters. At present there seems to be no simple, cheap and reliable apparatus available for the determination of very low gas velocities. The oscillating tube, with its high sensitivity to changes in capacity, seems to offer a most promising answer to this problem. It will only be necessary to cause the small pressures set up to vary the frequency in an oscillating circuit and convert them to velocity changes.

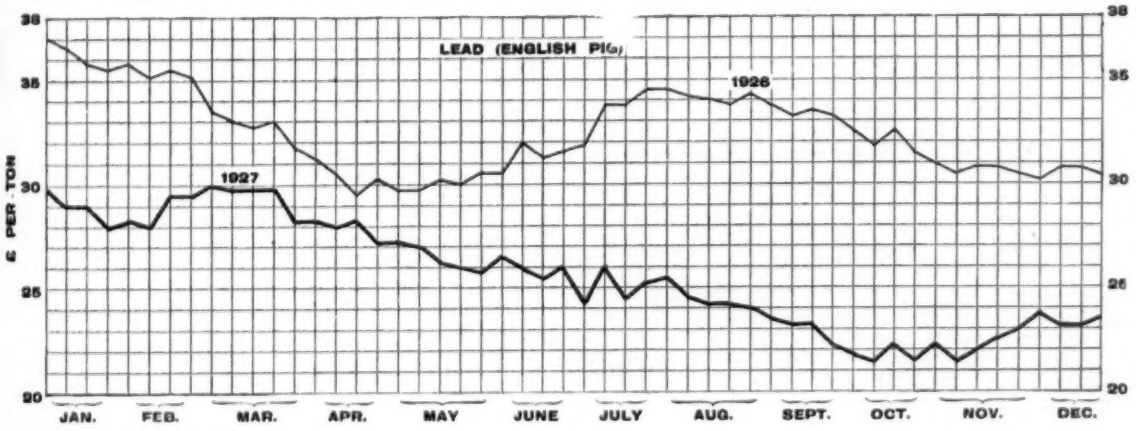
One machine available for the control of thickness or composition of sheet goods works on a slightly different principle from those already mentioned. If an oscillating circuit be set up and a second simple circuit consisting of merely an inductance and a capacity be set up near the first circuit, then the amount of current transferred to the second circuit by induction will depend on how nearly the second circuit is in tune with the first circuit. In the commercial apparatus, a current of constant high frequency is generated by means of a vacuum tube. A second circuit is made up of an inductance and a capacity. It is merely necessary to make the varying current actuate a control mechanism in order to obtain a uniform product. Such an arrangement is far superior to hand control and is so sensitive that most of the machines so far installed have had to be damped in order to decrease their sensitivity. If instead of allowing the product to pass between the plates of the condenser, these plates are held apart by some material sensitive to moisture changes, then changes in moisture will cause a change in the distance between the plates. This gives a sensitive method for determining or controlling moisture, as changes in the plate spacing mean capacity changes that are indicated by changes in the current flowing in the measuring circuit.

Copper, Lead and Rubber Prices.

The Past Two Years' Movements Compared.

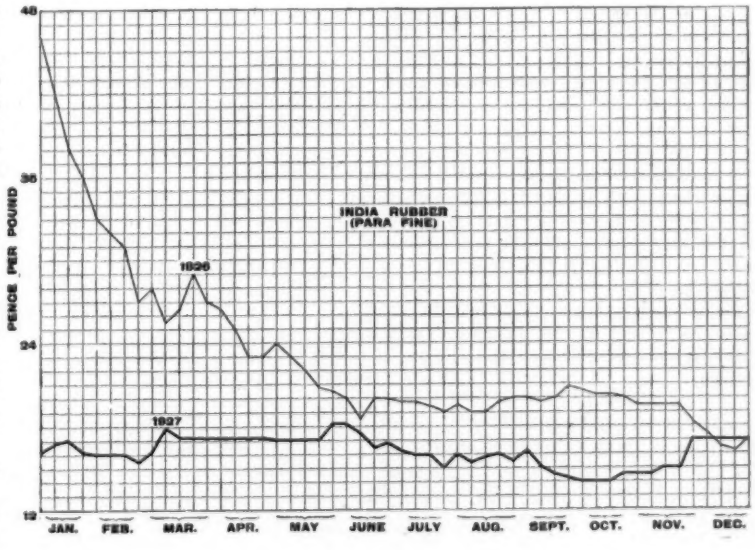
THE curves upon this page trace the variations in the prices during 1926 and 1927, of three materials of importance to the electrical industry—copper, lead, and rubber. They are based upon the prices published every week in our "Business Notes" section.





The curves illustrating the course of prices of copper (electrolytic bars) show that until December last the 1927 level was consistently below that of 1926—the difference at two periods being as much as £13 per ton. Towards the close of the year, however, the 1927 curve rose above the other and manifested a tendency to mount still further. The variations in 1927 were far more violent than in the preceding year.

Lead prices showed a gentle downward trend during last year, and throughout the period kept well below the 1926 course of prices. The general tendency at the end of the year was a rising one. For over three months the difference between the two years' prices remained almost stationary at about £10, but it narrowed in December. The margin between the highest point of 1926 and the lowest of 1927 was over £15 per ton.



Reporting on December 31st, Messrs. James Forster and Co. stated that consumers' demand for lead had shown signs of reviving during the last two days, particularly for early arrival. Imports, however, owing to the Continental demand of a few weeks ago when lead destined for this country was diverted, were none too plentiful, with a consequent tightness. With the prospect of a renewed demand from consumers after the turn of the year, and supplies on a moderate scale, it seemed probable that prices would make a further advance during January.

After two turbulent years, rubber reached stability; the prices moved only within the narrow limits of 1s. 2d. and 1s. 6d. per lb. for Para fine, whereas at the commencement of 1926 the price was 3s. 10d. Last year's curve, similarly to that for copper, kept below the 1926 course until December, when it rose a little above; the last point was 1s. 5d. in each year.

Radiological Apparatus.

The author discusses the engineering aspect of X-ray equipment, based mainly on his observations at the recent London Radiological Exhibition, together with his own experience both as a radiographer and an engineer.

(From an Engineering Correspondent.)

IN the thirty years during which X-rays have been known and applied, apparatus has improved continuously, and at present shows no sign of finality. The British Institute of Radiology, by holding exhibitions of apparatus periodically, such as the one in London on November 17th and 18th, 1927, does much to help progress by showing various makers' exhibits side by side for direct comparison. In this way the period required for the survival of the fittest is considerably shortened, and types become obsolete more quickly that when such apparatus is only seen in the manufacturer's showroom, or in use at a hospital.

From an engineering point of view there is much to criticise in present-day apparatus; the reasons why the engineering side of the development is so far behind the technique and application of X-rays is believed to be due mainly to the actual users. Although large industrial installations are in existence, by far the majority of users of X-ray installations are doctors, and the medical profession is a very conservative body. At the outset, certain ideas quickly became fixed, principal amongst them being those of the penetration necessary and the exposure, using the term to mean that of (current × time) or milliampere-seconds. There was no definite standard on a really scientific basis: the general rule was to use an alternative spark gap, consisting of two opposing pointed rods, and to state that when the gap just sparked over at, say, six inches the penetration was that of a 6-inch gap, or that the tube was a "six inch" one. In engineering practice it has long been realised that sparks between points are most unreliable, and at present sphere-gaps are exclusively used when any accuracy is required. In order to make radiography a more or less exact science, measurements are necessary, and if measurements are no more reliable than, say, 50 per cent., the best use is not being made of the apparatus.

Considering nomenclature, for instance, the words "amperemeter" and "milliamperemeter" have been discarded for years by engineers in favour of the more practical terms "ammeter" and "milliammeter." Another obsolete term still perpetrated (sometimes by engineers too) is "periodicity," which word is deprecated by the British Engineering Standards Association; "frequency" has been the recognised term for years. The general levelling-up of engineering terms outside the purely engineering industry can only be to the advantage of everyone. It is manifestly ridiculous that an instrument, or piece of apparatus, should be called one thing by the designer (an engineer) and another by the user (the medical man). Another instance of incorrect nomenclature is that of "motor-convertor," used by one firm in describing a machine having a common field system, but with two armature windings. A motor-convertor consists essentially of two coupled machines, half of the power of one machine being transmitted to the other through the shaft and half through connecting leads—quite different from the motor-generator which is used for radiographic work.

If the generation of X-rays is considered under the following headings, the subjects may be dealt with as follows:—

Generation of High Voltage.

The two main types of apparatus available are the induction coil for interrupted d.c. and the transformer for a.c. systems. The former is now nearly obsolete, and its decease is being hastened by the more general adoption of a.c. distribution; of course, an induction coil energised by accumulators is quite obsolete for all except mobile and out-of-the-way installations. An objectionable feature of the induction-coil method was the interrupters; although they could be made to work satisfactorily for long periods of time, they were in general not reliable, and would often fail without notice. The transformer is a much sounder engineering proposition, for induction-coil theory is not completely known even at the present day, but the action of a transformer can be predicted with considerable accuracy, and its efficiency is higher.

The earliest transformer outfits were naturally designed for single-phase supply (the most widely used at present) as its use entails a minimum of one rectifier only, or even none if very small power is required, when a self-rectifying X-ray tube may be used. For a very large installation it may be impracticable, or uneconomical, to obtain a single-phase supply from three-phase mains, although, except perhaps with the very largest sets, the unbalancing of the supply system resulting from the intermittent single-phase load need not be considered. If a large installation is contemplated and the supply authority will not allow a large unbalanced current to be taken, alternative methods of procedure are to install a motor-alternator, driving the motor from the three-phase mains and generating single-phase, or to use three-phase, or three single-phase, transformers and six rectifiers; this has been done in some of the larger installations now in use. The coil outfit is essentially a "shock" method, the voltage and current wave-forms being extremely peaky and irregular, but the six-rectifier system produces a nearly constant voltage, which is an ideal dreamed of by many radiologists.

If the case of an X-ray tube suitable for use at, say, 150 kilovolts, peak, be considered and for the work in hand 150 kilovolts peak be the best working voltage, a constant-potential supply is clearly the most useful, so that the tube may be run at its maximum rated voltage. If a single-valve rectifier be used, the transformer peak voltage may still be 150 kV as before, but (owing to fluctuation) the "useful" voltage on the tube will be less than 150, and this amount will be nearly proportional to the current taken by the tube. The use of condensers to maintain the voltage is sometimes resorted to.

Rectification.

Thermionic rectification is now probably the most widely used, and it is likely to increase further in popularity, as outputs increase and transformers on a.c. mains are used. Mechanical rectifiers, although having certain inherent advantages, are in general not so good as thermionic ones. If the supply is a.c., it is necessary to provide a small synchronous motor to drive mechanical rectifiers, and thus introduce an additional piece of apparatus. For coils energised by d.c. and using a motor-mercury interrupter, the mechanical rectifier has some scope, as it can quite easily be driven synchronously with the interrupter. Spark-gaps and valve tubes are now practically obsolete. They may still have a narrow scope for very small and occasionally-used plant when first cost is the prime consideration.

Judging by the exhibits at the recent exhibition, few manufacturers, and probably fewer users, know much about thermionic rectification. It is generally stated by the makers that the emission from the filament is proportional to the filament current, and for that reason and simplicity an ammeter is inserted in one of the filament leads. This idea and practice are quite wrong:

the emission is proportional to the temperature of the filament, not to the current; therefore, as the filament wastes during life (as it must do) a given constant current will raise the temperature of the thinner filament more than when the filament is new, with the result that the valve's life is shortened. The case is similar to that of the valves used for wireless, and it is known from experience with such valves that if a filament is run at constant current it will have a life of only a quarter of that obtainable by running at constant voltage. This is an important point, especially as the cost of thermionic rectifiers is high and their economic life of great importance. Conversely, if a filament is under-run as regards temperature its life will be increased, and the point where the optimum life is obtained is purely a question of economics depending on cost of rectifiers and cost of power.

It was noted at the exhibition that only one maker provided filament voltmeters, and the practice is greatly to be commended to all manufacturers in view of the above-mentioned fact as to relative life at constant current and constant voltage. The running of a filament at constant voltage is not quite identical with constant temperature, but it is very nearly the case in practice.

Generation of X-rays.

There is very little of real engineering importance in this problem, the main scope being rather electrical physics.

The gas tube is still used to a large extent, and some stands at the exhibition appeared to show them as their chief line, with Coolidge tubes rather as a side line. With this exception, the use of Coolidge tubes is increasing, as is to be expected from their good characteristics.

Regarding the employment of the rays to best advantage, this article is limited to the engineering side and consequently there is little to be stated. It appears that this side of the apparatus is the best and most up-to-date and, compared with what was available, say, 10 years ago, present apparatus is a tremendous advance.

In one respect is the engineering side concerned, and that is protection from the e.h.p. This does not appear to be of anything like so much importance as an engineer would expect. The average engineer would think twice before he got within a yard of bare leads of 100-200 kilovolts, whereas the medical man does not seem to mind. It must also be pointed out that a shock from the e.h.p. system of a modern set with the supply mains to back it up is far more likely to be fatal than a shock from an induction coil, and that the occasional shocks experienced with old apparatus do not lead to immunity from trouble with present-day outfits; no set is really and absolutely fool-proof. With enclosed tube boxes it is often worth while to incorporate some red-lamp device to show when the mains are live, the lamp being connected to the primary of the transformer, of course.

Another noticeable point is that most of the outfits shown were in wooden containing cabinets; whilst they look very nice, they are not a sound engineering job and it is quite conceivably possible for, say, a man carrying a stretcher to push it through the wall of the cabinet; it is certainly not fireproof. Some sets were contained in metal cases and represented an improvement from the engineering point of view. In a metal-clad set it may be necessary to use a slightly larger cabinet in order to increase sparking clearances. If this is so, it appears that the present wood-cased set is unsafe, as anyone might draw a spark through the wooden case. All metal cases, transformer cores, &c., should be solidly earthed, but a well-insulated floor is almost essential.

Measuring Instruments.

With very few exceptions, the measuring instruments incorporated in sets were of Continental manufacture, which fact is deplorable, for there are so many instrument firms in this country producing good instruments for ordinary power work that it seems a bad state of affairs that almost the whole of the ammeters and milliammeters used in the radiological industry should be imported. Where the fault lies is not obvious. It may be pure inertia on the part of X-ray apparatus manufacturers to try British instruments after having used Continental ones from the early days, and it may be due to inertia on the part of our instrument makers in not studying the market and catering for it.

The idea that any cheap instrument will do is incorrect, more especially in the case of filament voltmeters. When it is realised that a change of 1 per cent. in voltage affects the life by 15 per cent. and a 5 per cent. change in voltage halves or doubles the life, it will readily be seen that accurate instruments for this purpose are essential. Unfortunately the range of voltmeter for this purpose is low, say less than 10 volts, and a.c. voltmeters of this range are not usually as accurate as those of higher ranges. However, improvements in a.c. instruments are now taking place whereby very good accuracy can be obtained. A cheap foreign instrument may be much worse than useless.

Further, as the filament voltages need only occasional adjustment, it seems rather unnecessary to use two or more voltmeters. A four-rectifier set needs three voltmeters only, as two filaments are at a common potential. Some form of plug-in voltmeter should be useful here, and the operation of adjusting all the filaments on the same voltmeter tends to give them all equal voltages, whereas if two or three voltmeters are used the instrument errors would tend to make differences in the actual voltages applied. One small difficulty with the scheme of using a common plug-in voltmeter is that the voltmeter itself requires a current; if the voltage is adjusted on the instrument, which is then unplugged, the filament voltage would alter slightly; if the voltmeter were never left in circuit on any rectifier, all would have the same treatment, however. The error is least as the voltmeter resistance increases, and a value of about 50 ohms per volt is about the lowest limit of resistance that should be tolerated for an a.c. voltmeter. Some of the foreign instruments may be found to be as low as 20 ohms per volt. The voltmeter for the Coolidge tube filament need not be so critical, as the emission is actually measured by the output milliammeter, so that the filament is in effect run at constant temperature, for a given current through the X-ray tube; a voltmeter is still preferable to an ammeter, however.

Another departure from standard engineering practice is in the use of brass cases instead of iron, in a number of instances. In engineering iron cases are used, not for cheapness, as one might imagine, but because of their magnetic shielding properties. An a.c. instrument in a brass case is prone to be affected by stray fields caused by the proximity of other instruments, heavy-current leads, transformers, &c., but if enclosed in a suitable iron case it will be practically free from any such disturbances. The iron case may, of course, be finished in any manner required to suit the user.

For measuring the high voltage, the point-point spark gap, as mentioned earlier, is most unreliable: its spark-over voltage depends on the degree of pointedness of the electrodes, and so results with one spark gap may not be repeatable with those of another. It is further affected by atmospheric conditions, frequency, and wave-form, and as wave-forms are by no means the same with different sets the error may be appreciable.

The point-plate gap is very little better as a voltage-measuring device, but the sphere gap has none of these disadvantages. The diameter of the spheres, which should be equal, should be such that the usual working voltage corresponds to a spark of length equal to the diameter, the limits being from a fraction of the diameter to one and a half times the diameter. With standard sphere-gaps very great accuracy is obtained, and in fact this forms one standard method of measuring very high voltages.

It may be said that the user is accustomed to speak of, say, "a six-inch spark," meaning the alternative spark between points, and that he will not be bothered with anything better. This is a very short-sighted policy, and all progress in science should be utilised as far as possible by making reliable measurments. Inertia again is the root of the trouble of the retention of the old point-point, or point-plate, spark gap, and the old designation of penetration.

As a "running" indication, most large outfits now include a kilovoltmeter graduated directly in kilovolts; it is useful, but not entirely accurate. The voltmeter is a low-range instrument operated from the primary winding, or from a special voltmeter winding on the secondary, of the transformer. The drop in voltage on load is not shown on the instrument, neither is the (variable) drop in the rectifiers; hence, the kilovoltmeter generally reads high, and shows only the highest voltage possible under no-load conditions. A directly-connected kilovoltmeter to give true readings of voltage on the tube is in general quite out of the question on account of expense, although it can be done, and such instruments are marketed.

Fortunately, the tendency with modern transformer and thermionic rectifier sets is to specify penetration in terms of peak kilovolts instead of by the alternative spark-gap, but at the present rate it will be a long time before the old method is completely discarded.

The penetrometer, qualimeter, and oscilloscope are practically obsolete. The two former have been replaced by the peak kilovoltmeter, and the present-day rectifiers render the use of an oscilloscope unnecessary.

Other Considerations.

On the low-voltage side it is surprising that more use is not made of a battery-switch device for changing the tapping on auto-transformers, when these are used. One or two firms make use of this method, but its use is not general.

The rating of X-ray sets is a very controversial subject, and it is believed that it is being considered in connection with the B.E.S.A. Specification for Transformers for X-ray Work shortly to be issued.

Finally, attention should be called to the correct use of electrical engineering symbols, both graphical and literal, by all users of electrical apparatus. Only by rigid standardisation in this way is it possible to avoid confusion and error when different apparatus or results are being compared on paper.

A list of correct graphical symbols is given in B.E.S.A. Specification No. 108—1922 and literal symbols in B.E.S.A. Specification No. 205—1926.

Delivery Estimates and the Limiting Feature.

The Endeavour to Meet Promise with Performance.

By W. J. HISCOX.

A HIGHLY developed progress organisation is necessary in the factory where individual orders are accepted on a delivery basis, and especially when the units covered by the orders have to be built up to conform to the customer's specification. It means that every phase of manufacture has to be time scheduled, and the efforts of the progress organisation have to be directed to the task of ensuring that the time limit is adhered to in each instance.

A striking example is furnished by the manufacture of induction motors, which cover such a wide range and are so varied in detail as to render it really impracticable to hold in stock sufficient completed units to satisfy the variable requirements. During the past few years, however, it has been found possible to classify requirements and thus bring about a certain measure of standardisation in respect of detail, so that component parts, and in some cases sub-assemblies, can be stocked, this materially shortening the time for the completion of the unit, and considerably reducing the cost of production.

But, although this undoubtedly eases the situation in one direction, it increases the difficulties in another because, the special feature not being eradicated, it becomes more formidable by reason of the greater number of orders, for it is obvious that orders will increase if, as a result of partial standardisation, deliveries are shortened, and the price of the product is lowered. Standardisation may affect eighty per cent. of manufacture, but it is the remaining twenty per cent. which is likely to cause trouble, chiefly because the special feature is not only there, but is also elusive.

Let us see what this means. It is assumed that the standardised unit can be built up from parts held in stock—probably the stator and rotor cores can be drawn from stock in an assembled state, ready for winding, together with the endshields, bearings, &c., required for the final assembling. The wire and insulation can be drawn from stock, and it is possible that the coils, wound on a former, can also be stocked. All that remains to be done then is to wind the stator and rotor to the specification suited to the customer's requirement, and assemble the unit for test and dispatch. This type of product can be handled on a quick-delivery basis, and, so long as adequate stocks are maintained, it causes the progress man little trouble.

Next, there is the semi-standardised product, or, as it may perhaps more accurately be termed, the standardised product with a special feature, and this may prove to be a simple proposition, or the reverse, according to the special feature. The speciality may be nothing more than a pulley, which is held in stock as a casting, and which can be machined and made ready for fitting to the motor by the time the stator and rotor have been wound. Perhaps, however, the pulley required is not stocked as a casting, and has to be specially cast, but as the pattern is in existence, it is possible to get the pulley cast and machined by the time it is wanted for fitting to the motor. On the other hand, maybe a new pattern has to be made, which, of course, complicates matters, and the point to be considered in this instance is whether the pulley is to be regarded as the limiting feature, upon which the estimated delivery of the unit is based.

Although a pulley has been mentioned for illustrative purposes, the special feature might just as well be a coupling, endshield, or any other component which is not wanted until the final assembly of the unit. The question is whether its inclusion will remove the unit from the standardised category for delivery purposes, and this must be decided by the progress man before giving the estimate.

The special feature may be a rotor shaft, and the importance of this, from a delivery standpoint, is governed by manufacturing procedure. If the core laminations are built directly on to the shaft, and the provision of a "dummy" shaft for temporary purposes

is not favoured, it is obvious that the rotor cannot be assembled until the special shaft is forthcoming, and the shaft must therefore be the limiting feature on the delivery estimate. But if, on the other hand, the core can be assembled and wound on a "dummy" shaft, or if the core is built on to a spider, it is possible that the special shaft can be completed by the time the rotor is wound, in which case a delivery estimate for a standardised unit can be given.

We have thus far dealt with special features which might or might not affect the delivery date, and they are by far the most embarrassing, from the standpoint of the progress man. It is difficult to know what to do when estimating a delivery in these circumstances, and the natural inclination is to play for safety, or, in other words, assume that the special feature *will* be the limiting feature. But orders nowadays are not easily come by, and delivery is such an important factor in deciding the placing of an order that the management is apt to criticise any delivery estimate which might cause the order to go elsewhere. On the other hand, failure to meet a promised delivery has an adverse effect upon future business, and estimates must not be given without thought for the obligation to meet the delivery given. It is safe to say, however, that wherever possible the progress man is prepared to take a risk to secure the order, and rely upon the efficiency of his organisation to enable him to meet his commitments.

DATE SCHEDULE.

Order No. *12345* Customer *Blank, Cross & Co.*

Quantity *4* Type *G.H 5 Motors*

Date Issued *29-9-27* Unit due for Completion *27-10-27*

No.	DEPARTMENT	Completion Dates.		
	Purchasing			
2	Stores	4/10 Core	15/10	
	Pattern			
	Foundry			
	Tool			
1	Press	4/10		
	Smith's			
3	Machine	6/10 Shaft	15/10	
4	Core Assembly	6/10 Stator	10/10 Rotor	
5	Winding	15/10 Stator	21/10 Rotor	
6	Final Assembly	22/10		
7	Final Inspection	24/10		
8	Test	26/10		
9	Dispatch	27/10		

Fig. 1.

The final special feature associated with the semi-standardised product is the one which is obviously the limiting feature, and upon this the delivery estimate is based. For illustrative purposes, core laminations, either stator or rotor, are selected. The only point for the progress man to consider here is whether the die exists, or whether a new one has to be made, as, although it is known that the necessity for special laminations must extend the delivery estimate, it is obvious that, if a new die has to be made, the extension must be longer than if the laminations could be produced from a die already existing.

In the third category appears the special product—that is to say, the main parts of the unit have to be specially manufactured, although perhaps most of the smaller details can be taken from stock. A detailed specification is necessary here to enable the progress man to give a proper delivery estimate, and it is well if the sales office can assist, by giving some indication of the probable limit. For example, if delivery is of vital importance, the salesman can, in all probability, say what delivery limit can be given, without losing chances of securing the order, and in the circumstances special efforts could be made to make the estimate conform to this, while, on the other hand, if delivery is not so important, the estimate can be made with due regard to existing commitments.

As before mentioned, an effective progress organisation is necessary to ensure success, and the following shows the procedure favoured in a factory where there are hundreds of individual customers' orders continually being handled.

In the first instance, there is a central progress office, the *personnel* of which is composed of high-grade men, fully capable of estimating deliveries, and ensuring that the deliveries are met. One man is in charge of each line of apparatus, but as induction motors have been selected for illustrative purposes, we will show how the procedure operates in this connection.

PROGRESS TALLY.

Order No. *12345* Customer *Blank, Cross*

Type *G.H.5* Piece *Stator*

DEPARTMENT.	Completed.	Left.
Core Assembly ..	5/10	6/10
Winding	15/10	17/10
Dipping ...	18/10	18/10
Testing	18/10	19/10
Final Assembly .	24/10	26/10
Test	27/10	27/10

RETURNS.

WINDING.

Final Assembly ...		
Test		

Fig. 2.

Upon receipt of an inquiry in the sales office, particulars of the requirement are entered upon a form and sent to the technical department, where the requirement is analysed and placed in a definite category, this bringing it to a recognised size of motor. Any peculiar requirements are noted, such as the winding specification, an extended shaft, &c., of which brief particulars are added. The form is then sent to the drawing office, where the requirements, as set forth by the technical department, are carefully scrutinised, and compared with the standardised or semi-standardised products of the firm. The drawing office then estimates the time necessary to prepare the detailed specification, together with drawings, if new ones are required, and the form is sent to the progress office. At this stage all essential particulars are in evidence on the form, to enable the progress man to estimate the delivery, and the following facts are elicited:—

(1) That the requirement is a certain size motor, wound to a standard specification, containing no special

features, and all parts are obtainable from stock. The working specification will be available within two days of the receipt of order.

(2) That the requirement is a certain size of motor, all parts of which are obtainable from stock with the exception of (*a*) the stator laminations or (*b*) a special shaft or (*c*) special endshields. In regard to (*a*), reference is made as to whether the die is existing, or a new one is to be made. The working specification and drawings (including one for a new die, if necessary) will be available within seven days of receipt of order.

(3) That, although a certain size of motor is specified, this does not, except so far as small details are concerned, conform to the recognised standard. The frame and other main essentials must be specially manufactured, and it is, in effect, a special product. Complete working specifications and drawings will be available within three weeks from receipt of order.

It is upon this information that the progress man bases his delivery estimate, taking into consideration his current commitments. For example, there may be a heavy run on one specific size of motor, and in these circumstances it may be necessary to quote a fairly long delivery to ensure its being kept, while, should there be a slump in regard to the size now being estimated for, it may be considered advisable to give a "cut" delivery, with a view to making sure of the order.

The form, which, it should be mentioned, is made out in duplicate, is now completed, and is returned to the sales office, the duplicate being retained by the progress man. If in due course the inquiry materialises into an order, a copy is received by the progress man, reference being made thereon to the delivery promised. The order is filed with the estimate until the working specifications appear.

When these arrive, a delivery schedule (fig. 1) is made out for each of the manufacturing departments concerned with the order, and these are distributed. The specification shows what departments are involved, and the amount of work to be done in each, together with the date for the completion of the order, governs the allowance in each instance.

In each manufacturing department there is a "progress chaser," controlled by the progress man in the central office, and he is responsible for seeing that every delivery date is kept, so far as the department in which he is located is concerned. He has daily consultations with the department foreman, and reports to the controlling progress man any matter likely to have an adverse effect upon deliveries.

A tally (fig. 2) is attached to each stator and rotor when the core assembly is complete, and this remains until the completed unit has been tested, particulars being inserted at the completion of each phase of manufacture.

Purchasing for Retail Selling.

Some Simple Methods Outlined.

By ERIC N. SIMONS.

THE subject of retail purchasing bristles with pitfalls for the unwary. The majority of buyers have their own notions of running their department, and regard with scorn any suggestions that do not coincide with their particular ideas. Perhaps the best way of beginning this article will be to give a brief outline of actual working systems.

The shop where these methods are in operation has a centralised buying department. Each section, *e.g.*, wireless goods, lamp shades, heating apparatus, &c., has a series of symbols to represent its various requirements, so that production costs for each can be analysed with maximum accuracy. Each department requisitions for supplies to the buying department, and its written requisition carries the symbol appropriate to the section for which the supplies are needed (see fig 1). The whole of these requisitions, as received by the buying department, are then analysed and classified. Each of these classifications or sections is supervised by a member of the department under the control of the head buyer. Where similar materials are ordered by different sections, quotations are obtained for the aggregate quantities, and in many instances lower prices are secured than would have been the case had each department ordered separately. After the head buyer has considered the various prices received, and has chosen the firms with whom to place orders, he passes the requisitions to a typist, who from them makes out the official orders.

REQUISITION.

To be charged to		Date.
Symbols.	Particulars.	To be ordered from.
		Signed.

Fig. 1.—Simple Requisition Form.

These are not bound up in a book, but are printed as single quarto sheets, each bearing a consecutive number. In addition to the original, bearing the printed instructions for the supplier's guidance, three copies are taken for internal use. Then the original is sent to the supplier; the first copy remains in the buying department, and is bound up and filed; the second copy goes to the receiving department or official; the third copy goes first to the owner, manager, or chief official of the shop for examination and approval, and is then passed to the requisitioning department as a proof that the supplies have been properly ordered.

In this way expenditure is controlled by the management in the quickest and most satisfactory manner; the stores department, weighman, or receiving official knows exactly what goods are likely to be delivered in the immediate future, and by whom; and finally, the department that ordered the supplies has all the necessary particulars to enable it to take up the question of delivery, should that become necessary.

The next step is to record both orders and contracts in such a way as to facilitate reference. There follows the necessity of securing prompt delivery of all goods ordered. This, again, is done by a simple method. A rule of the buying department is that a delivery promise must accompany each quotation. When the order is sent out, a clerk records the order number on the appropriate date card. Each day the clerk consults the current date card, and if deliveries of the orders written on it have not been made, he takes out the card and writes pressing for delivery. The card is not put back until definite replies have been received. If a new promise is made, this again is recorded on the card for the date on which delivery will be made; thus, no order is allowed to escape notice. The system requires the

minimum of clerical work, and saves a tremendous amount of time.

The form shown in fig. 2 is sent to each supplier, and has to be returned with the date of delivery clearly specified.

PROMISE OF DELIVERY.

This form is to be filled in by suppliers and returned *at once*. The promise of delivery is to be adhered to, as far as possible, in every case.

Full order No. Date. Material.

The material to the above order will be delivered on

.....192...

Suppliers' signature.....

Date.....

Fig. 2.—Form for Delivery Promise.

The mere ordering and securing delivery of supplies is but one part of the buying department's work. There is the examination and checking of materials delivered, a task of exceptional importance. Apart from small deliveries by parcel post, there are only two ways in which goods can reach the shop, namely, by hand or by vehicle.

On arrival of a consignment of goods, the receiving official makes out a duplicate slip showing the order number—as ascertained from his own records—the weight, quantity, and the date of delivery. One of these he retains, and the other is dispatched to the purchasing department. In the meantime he examines for defects or damage such goods as he is competent to examine. In all other instances the buyer himself, or the official with the appropriate knowledge, examines the supplies. On receipt of the stock-room delivery ticket, the necessary details are recorded on the cards, and the departments that requisitioned the supplies are notified of their arrival. The delivery tickets are then passed forward to the accounting department, as a double check on invoices.

In due course the supplier's invoice is received. The particulars on this are compared with the order, to ensure that the material is correct, the weight as ordered, and the price as arranged. It is then passed and initialled, and is also marked with the symbol of the department that originally ordered it. Then it follows the delivery ticket to the accounting department.

The methods of one existing buying department have been summarised here because they are fairly typical of an efficient and not over-systematised department, and because a concrete example is always more valuable than a merely theoretical enunciation of principles. But it is essential that some consideration should be paid to the principles underlying each branch of purchasing methods, and that the essential points to be borne in mind for each branch should be thoroughly understood.

Phase Sequence Tests.

A Simple and Inexpensive Method of Testing.

By G. W. STUBBINGS, B.Sc., F.Inst.P., A.M.I.E.E.

THE determination of phase sequence is called for in a number of diverse circumstances. In commissioning a new alternator, or in coupling together two power stations, such a determination is of first importance, and, in view of the fact that the two circuits whose phase sequence is to be compared are at high pressure, the matter requires great care and a thorough understanding of the sources of error. In low-pressure supply circuits, a knowledge of phase sequence is frequently required for the correct connection of polyphase meters and of induction motors required to rotate in a definite direction. In such circumstances simple methods of testing requiring no particular skill, and which can be carried out with the minimum of delicate apparatus, are of great value.

There is little difficulty in devising methods of testing phase sequence by the use of electrical instruments. In the case, for instance, of a 3-phase meter supplying a load which is known to be approximately balanced and of a lagging power factor not less than 0.5, we know that the torque in the leading element is greater than that on the lagging element. If, therefore, we reverse the potential on one element, this element will be in the leading phase if the direction of rotation of the meter disk is reversed, and *vice versa*. If the power factor of the load is nearly unity, the conditions corresponding to a lagging power factor can be simulated by connecting lamps of equal rating in series with the two pressure circuits.

The phase rotation indicator is a very useful piece of apparatus for the test under consideration, as it gives the required indication without any manipulation of connections. A single-phase meter can be used as a phase sequence indicator by inserting sufficient resistance in its pressure circuit, so that when the series coils are supplied with the current taken by a non-inductive resistance connected between two phases, and the potential circuit is so connected between one of these phases and the third as to give decided rotation, the leading phase of the two supplying the series circuit is indicated by the direction of this rotation. Such methods, depending for their indication on the rotation of a moving element, are not altogether satisfactory, and static devices are in many ways preferable, as being less likely to get out of mechanical order, and less expensive.

Probably the best-known statical device for the determination of phase sequence is the two lamps and reactor combination. Although this arrangement is well known, it will not be out of place briefly to refer

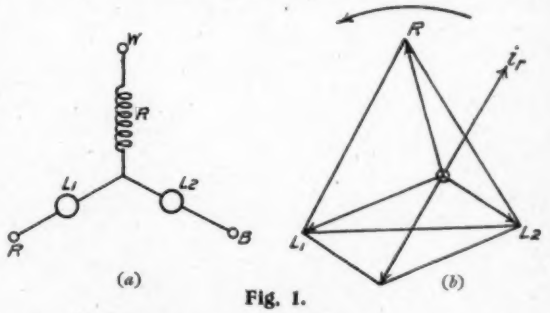


Fig. 1.

to it. In fig. 1 (*a*) we have two lamps of equal rating, and a reactor joined in star, and connected to the supply terminals, the phase sequence of which we wish to determine. When so connected the lamps will glow with unequal brilliancy, and the phase which is connected to the dull lamp leads that which is connected to the bright lamp. The proof of this rule constitutes a very elegant example of the use of vector analysis. In the vector diagram of fig. 1 (*b*), OL_1, and OL_2 are the voltages in the bright and the dull lamps respectively, and the vector OR is the voltage on the reactor. As the

lamps are of equal resistance, and are practically non-inductive, the vectors oL_1 and oL_2 represent in phase and magnitude the currents in these two lamps, and the reversed resultant oi, accordingly represents the current in the reactor. As this current must lag the voltage oR, we can place on the diagram an arrow expressing this fact, from which we obtain at once the phase sequence of the phases connected to L_1 and L_2.

In actual practice a condenser is in many ways preferable to a reactor, as being lighter and more portable for a given impedance. When a condenser is used, the phase sequence is reversed with respect to the indications given by a reactor, the bright lamp phase now leading the dull lamp phase. It is always advisable to include a switch in the reactor or condenser leg, in order that the approximate equality of the impedances of the lamps may be checked by observing that they glow with equal brilliancy when they are connected to two of the phases, whilst the third phase is disconnected.

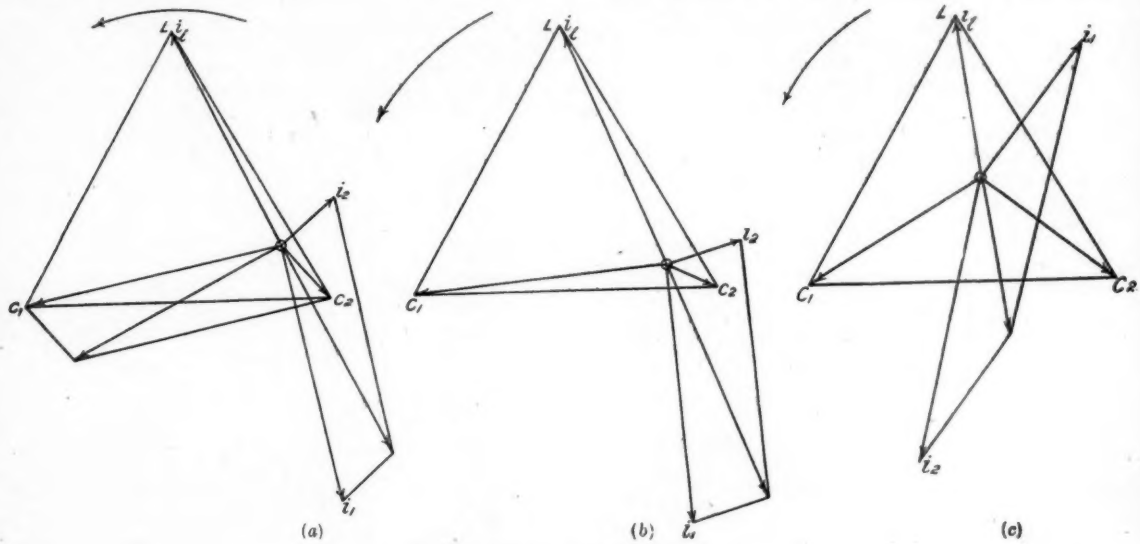


Fig. 2.—Vector Diagrams.

There are certain defects attendant on the use of this device which make it desirable to see if some improved method cannot be devised. Lamps are not very convenient to carry about, and the indications of the method depend upon two similar lamps being available. The method about to be described requires one lamp only, and as the rating of this is not very material, it can usually be obtained on the job where the test is to be made. We are not aware whether this test is original, but we do not recollect having seen it described before.

In the method of testing phase sequence now to be proposed, two condensers of equal capacity and a single lamp are connected in star and joined up to the supply terminals. Each of the condensers in turn is shunted by a non-inductive resistance of an impedance approximating to that of the condensers. It will be found that when the condenser connected to the leading phase is shunted, the voltage in the lamp is increased, but when the lagging phase condenser is shunted, the lamp voltage is diminished. The proof of this rule cannot be given in so elegant a form as that for the two lamps and reactor method, but a brief study of the vector diagram in fig. 2 will make the matter clear.

For the sake of simplifying the vector diagram as far as possible, we consider the case in which the condensers and the lamp are of the same numerical impedance, the condensers being shunted with a non-inductive resistance of like value. Bearing this assumption in mind, we see that the currents in the condensers are proportional to the voltages across them, and that therefore the resultant of these two voltages reversed must lag the reversed resultant of the condenser currents, or the lamp current, by 90 degrees. The vector diagram for the case in which the condensers are unshunted will be as shown in fig. 2 (*a*), from which it will be observed that the voltage across the condenser connected to the leading phase is considerably less than that across the lagging phase condenser. The condenser currents oL_1 and oL_2 are shown leading the condenser voltages oC_1 and oC_2 respectively by 90 degrees, and the resultant of these currents is equal and opposite to the lamp current oi_l.

If, now, the condenser C_2 connected to the leading phase is shunted by a non-inductive resistance, the effect will be to cause the vector of the current in the combination to lead the voltage by less than 90 degrees. The angle between the currents in the two circuits containing condensers will thus be diminished, and the tendency will be to increase the resultant current, which is that in the lamp, and so to increase the brilliancy of the light. The vector diagram for the condition in which the leading phase condenser is shunted is shown in fig. 2 (*b*). Reasoning similarly, we see that, when the lagging phase condenser is shunted, the angle between the vectors of the currents in the two circuits containing condensers is increased, the effect of which is to diminish the resultant current, and so to lessen the voltage on the lamp. This condition is illustrated vectorially in fig. 2 (*c*).

The particular relative impedances for the several members of the testing circuits assumed for these vector diagrams would not be convenient in practice for a 400-V, 3-phase circuit, since the voltage on the lamp under certain conditions would approach 400 V. By using a condenser impedance greater than that of the lamp, the voltage on the latter need not exceed 250, and the variations in the voltage, by shunting the condensers, although not so great as in the case illustrated, are quite sufficient for a definite indication.

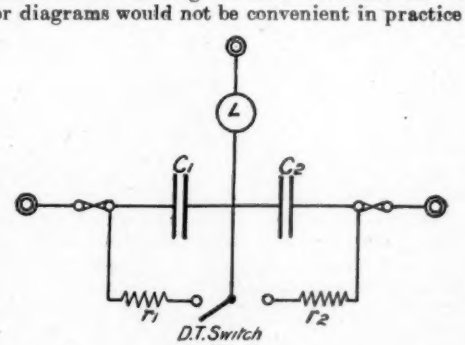


Fig. 3.

The method of testing we have just described is best applied in a practical form by a combination illustrated by the diagram of connections in fig. 3. Here two non-inductive shunting resistances are provided, these being equal in value and connected in such a manner that there is no possibility of a short circuit in the change-over switch. Such a combination, made up in the form of a portable testing set, would be plainly marked with the information that when the test lamp was bright, the handle of the throw switch pointed to the terminal connected to the leading phase of the two supplying the condensers. The terminal for the third phase, connected to the lamp, should not be fixed in line with the other two.

In conclusion, we may mention that the method of testing just considered can be carried out by the use of two reactors instead of two condensers. In an emergency the two pressure circuits of a three-phase meter will serve quite well, and the indication given by shunting each of these in turn with a lamp will be quite definite. When two reactors are used, the rule for the interpretation of the results of the tests is, of course, reversed, the reactor which, when shunted, increases the brilliancy of the lamp, being the one connected to the lagging phase.

Wayleave Legislation and Rights.

The author discusses the Legislative provisions necessary to secure the rights of location for overhead lines for public electricity supply, particularly in the light of "the right of eminent domain."

By WILLIAM T. TAYLOR, M.Inst.C.E., M I.E.E.

IN some countries power to exercise compulsory servitudes for electricity supply is confined to the Legislature, while in others it is exercised through corporate bodies or individuals to whom the Legislature has delegated the power; in this country the power has fallen upon the Minister of Transport, strengthened by co-ordinated bodies with technical knowledge, namely, the Central Electricity Board and the Electricity Commissioners. The powers granted are extensive, but scarcely wide enough adequately to cope with the requirements. But when the officer of this department, assisted by co-ordinated bodies with technical knowledge, is invested with *full* powers, which might include complete "eminent domain" rights and judicial and *quasi*-judicial functions, his scope and activities become very extensive and his duties far-reaching. Some of the main principles, in the writer's view, for which powers are urgently required in the interests of the public welfare, are:—

(1) Provision for the consideration of all applications for the grant of right of land by a competent technical independent central authority, with publicity and opportunity for objectors to file their objections.

(2) Provision for safeguarding undertakers and the public by the adequate control by the State of all cases in dispute where a public utility has clearly a minor importance, and for deciding the right of yielding to considerations of relative public good.

(3) Power to acquire land or any easements or servitudes or other rights without cumbersome procedure on payment of just compensation for the land for rural or any other lines.

(4) Provision for safeguarding the interests of *all*, not for the sole purpose of reaching a selected group of suppliers or consumers, but for the benefit of the ultimate consumer.

(5) Provision for safeguarding the public interests, by the adequate control by the State of supply undertakers (companies and corporations) supplying electrical energy to the public, directly or indirectly, so as to obtain and maintain the best possible economy and efficiency.

(6) Power to grant compulsory servitudes to authorised undertakers* on, over, or through lands on payment of compensation for the servitude.

(7) Right of the State to expropriate land and works and to construct works of public utility on payment of compensation to the owners.

(8) Provision for safeguarding the public and local authorities in the construction and operation of works, and of extensions, in the supply of electricity to the public, and in the control and purchase of surplus electricity.

(9) Provision for the formulation, authorisation, construction, operation, and maintenance—under State authority—of projects involving the most economical and efficient use of works, on their own lands, by authorised undertakers.

(10) Power to effect standardisation of systems and designs, to select generating stations, and to provide for interconnection of stations by means of transmission lines, and other matters, supplemental, incidental, and consequential, as may be necessary or expedient for obtaining and maintaining maximum economy and efficiency.

(11) Power of the State to authorise interest allowed, scale of depreciation, the striking of rates and matters of charge, the raising of money by loan, the financing and controlling of such community projects, and the passing of by-laws, &c.

The so-called "grid" schemes will represent but a portion of the problem involved in giving public service, and if a scheme as a whole is to give the best economy and efficiency, then we must first:

(*a*) Set aside obstructive policies of one form or another; stop attempts to extort exorbitant prices; and prohibit the entrance of abuses. These usually come from authorities controlling or using the roads or persons owning or occupying private land.

(*b*) Obtain, in reasonable time, the right of expropriation of land or to acquire land or easements or servitudes or other rights† for rural lines, so that the ultimate consumer is benefited and every one in the communities obtains energy at a price truly conforming with economy and efficiency. It is now recognised in rural areas that a supply of electrical energy confers benefits, direct or indirect, on every interest in the area, and that the delay and expense due to (*a*) and (*c*) are the cause of much loss to the community and the individual.

(*c*) Obtain crossings or right-of-way for that public utility which has clearly a major claim of public importance in the interests of the general public and not a selected few for private or business

* The Central Electricity Board will be the most important authorised undertaker, and second in importance will be the Joint Electricity Authorities.

† Obtainable from the Minister of Transport through the Electricity Commissioners.

purposes. This problem is of no less import than (*a*) and (*b*).

As regards relative public good and common welfare, a main transmission line or a distribution or service line is, in practically every case for the latter and always for the former, more important than a telephone line, and the great majority of the middle-class people and every citizen of the wage-earning class have no use for a telephone, although every person requires, and all are made happier and more comfortable by, the installation of electric light and heat and/or power. Throughout the whole world telephone and telegraph lines are classed as public utilities possessing a minor importance compared with electricity supply lines of any class; moreover, it is held that any public service undertaking with pole lines occupying *public* roads holds only a privilege of use and acquires no vested rights on roads or highways made from public funds and for general public good and usage. If the Minister of Transport controls public highways and roads, difficulties in the way of easements and relative public importance, &c., should be diminished satisfactorily.

The Minister of Transport has been invested with certain powers, but we shall not consider them for the moment; rather shall we discuss the *power* used effectively in other countries, *i.e., the right of eminent domain.* This inherent sovereign power gives the Legislature the control of private property for public use. It represents the power of the State to appropriate private property for public use, whether the owner consents or not, on payment of just compensation to the owner. The power exists only in cases where public exigency demands its exercise. Unforeseen occasions arise in which private property may be impressed into the public service or may be seized and appropriated to the public use. In English law the only exact analogy to the doctrine of eminent domain is to be found in the prerogative right of the Crown to enter upon the lands of subjects or to interfere with their enjoyment for the defence of the realm. Attempts are not made to exercise this prerogative, and lands are acquired for State purposes by statute usually framed on or incorporating the Lands Clauses Acts.

By the Prescription Act, 1832, it is enacted that uninterrupted enjoyment of a right-of-way for 40 years is an indefeasible right on condition that it is proved by user down to the time of commencement of the action, unless the consent in writing of the owner has been obtained by the enjoyment of the right. In English law, by an Act of 1833, uninterrupted possession for 12 years gives a good prescriptive title of land. An easement, *i.e.*, a right-of-way, is *prima facie* conferred by 20, and absolutely by 40 years' uninterrupted use, and in the absence of a written agreement. If an owner grant a piece of land in the middle of his field, the grantee has the implicit right to cross the granter's land without thereby committing trespass. In law, wayleave means the permission granted by an owner of property to enter for some specified purpose at reasonable hours. Easements in English law (servitude is Scots law and is borrowed from Roman law) lapse if not used for 40 years.

In some countries the law provides that the directors of a company shall apply to the Commissioners for a certificate of exigency, which shall state that the construction of a specified line for the transmission of electrical energy named in the application is consistent with the public interest; all other necessary data are also filed, as well as a map. The company (undertaker) is further required to publish a copy of its application in the local papers (or official paper) and to appear at a public hearing upon the question of the exigency. After the hearing the Board shall, if in its opinion the construction of the line is consistent with the public interest, grant a certificate to that effect, and a copy of the certificate is sent to those concerned, setting forth the route appropriately. It is also provided that, if the Board refuses to issue the certificate, no further proceedings may be taken within one year. In case the Board grants the certificate, the procedure is to give the directors of the company a specified time (usually 30-60 days) to make application to the authorities through whose territory the line is to pass for a detailed location, with a suitable map, and after due notice and public hearing, the route is fixed upon; in case no route is fixed within the specified time of the filing of the application, the directors may appeal to the Commissioners to fix the route, and the latter are authorised to fix the route; a certified copy of the Commissioners' decree is then dispatched.

The most important section of the Act is that providing for the exercise of the right of eminent domain. It is recognised that the company (undertaker) which has obtained authority to construct a transmission line under the provisions of the Act may lay out its route not wider than the width given in the Act, and if it is unable to obtain such land or such rights or easements therein as are necessary for the construction of its line by agreement with the *owner*, it may take any land within the limits of its location in fee, or may take such rights or easements therein as are proper for the construction and proper maintenance of the line and other structures as may be reasonably necessary from time to time for the safe and proper conduct of its business. The company (undertaker) is required to pay all damages caused by the laying-out, construction or maintenance of the line, or by the taking of land or of any rights or easements in land, and such damages upon the application of either party are to be estimated by the Commissioners in a manner provided in the Act.

The theory upon which these vested rights is exercised is that the rights of the individual must yield to considerations of public good and common welfare, and that the property of all is held subject to the right of the State (in its exercise) to appropriate it for public use.

Sometimes a limited power is granted by Legislature for the construction of a transmission line, and as a condition precedent to the exercise of the right, it has first to be certified, after a public hearing, that the company (undertaker) has acquired rights in the public ways or over private lands, for a given minimum percentage of the distance (sometimes for more than 75 per cent. of its length) through which it is to pass, and that the line is necessary and will serve the public convenience and be consistent with the public interest.

The powers given to a Board to supervise the granting of a certificate obviate any opportunity for the entrance of abuses. This is important, as we all know there has long existed the desirability of legislative authority to set aside obstructive policies. The power of "right of way" is in the public interest, and long experience has shown that persons in the communities are now paying more for the service of the energy than would be the case if the additional cost of lines, &c., due to attempts to extort exorbitant prices, were eliminated. Where the right has not been exercised, it has generally been found that the line has been more costly. The power of the right of way, or right of eminent domain, is not necessary only for the transmission of electricity in bulk, which practice might reduce investments of supply authorities delivering over certain areas; the right is for the benefit of the ultimate consumer. It may not be constitutional to grant the right for the sole purpose of reaching a selected group of customers. On the other hand, if private property can be taken for public use only, and if land is taken from any person and that person cannot turn round and demand a supply of the service, then such an act may be taken as a violation of the law. To justify more properly the exercise of this power, a use to the public must be fixed and definite, and must be one in which the public as such has an interest, while the terms and manner of its enjoyment must be within the control of the State, independent of the rights of, say, the private owner of the property appropriated.

(To be concluded.)

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A. Circle Campaign.

The latest report upon the Campaign received from the British Electrical Development Association states that 94 demonstration houses, exhibitions, &c., have now been organised or projected. The number of lecturers and lecture secretaries on the panel has reached 208, and 137 lectures in all parts of the country have been arranged.

The Next E.D.A. Conference.

Mr. E. P. Barfield, who was to read a paper on "Industrial Electric Heating: Sales Possibilities" before the E.D.A. Conference on January 20th, is unable to fulfil the engagement. A paper on the same subject will be read by Mr. J. H. Crossley, of the Metropolitan-Vickers Electrical Co., Ltd. The Conference will be held at the Royal Society of Arts, W.C.2, at 7.30 p.m.

Wages in Railway Power Stations.

According to the *Financial News*, under the terms of the existing sliding-scale agreement the wages of men employed in railway generating and sub-stations in London are to receive an increase of wages owing to the rise in the cost of living.

Modern Departmental Store Lighting.

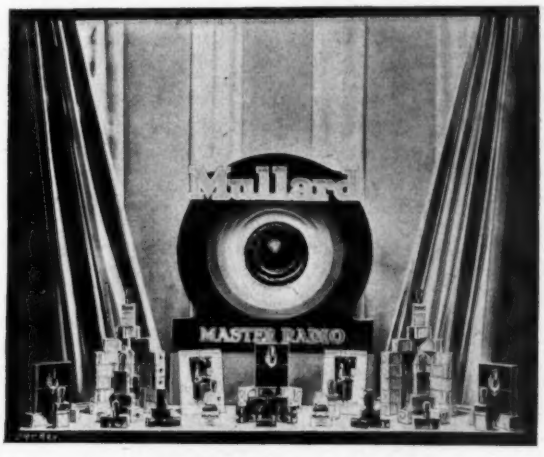
Messrs. John Barker's new store in High Street, Kensington, is an eight-floor building and possesses a spacious arcade which runs the entire length of the front of the establishment.

The Exterior of Messrs. Barker's New Premises.

The General Electric Co., Ltd., supplied a very large proportion of the fittings, reflectors, and lamps employed in the lighting scheme. One special feature is a system of concealed window lighting by the joint use of "Gecoray" silvered glass reflectors, and continuous lengths of mirror reflector, all of which have been so arranged as to make the introduction of colour a very simple matter. Footlighting—similarly adaptable for colour schemes and carefully concealed—is also included in all windows, while a comprehensive scheme of spot-lighting is employed, the latter being hidden in artistically-designed window furniture. The rear windows in the arcade and those in Old Court Place are illuminated with "Gecoray" silvered glass reflectors equipped with 200-W "Osram" gasfilled lamps which are concealed at the back of a pelmet, so that neither reflectors nor lamps are visible. The ceilings are curved from the back wall, and at the base of the curve a cornice lighting system is installed for providing additional lighting by the aid of concealed reflectors. In the two arcade island windows an invisible system of cornice lighting from specially-designed reflectors employing 20-W lamps is also installed round the top of the windows. Footlighting reflector also extends round the entire base of each of the two arcade island windows. The interior lighting is mainly carried out by means of about a thousand totally-enclosed "G.E.C." diffusing units. In these, 17-in. diameter white glassware bowls are employed, each being fitted with a 300-W gasfilled lamp. On the ground floor and in the basement silver-plated fittings equipped with 300-W gasfilled lamps are installed. The illumination of the mezzanine floor and the lounge is by ceiling-type fittings, each equipped with three 60-W gasfilled lamps. The whole building—which is illuminated from whichever direction it is approached—is made to stand out just as though it were situated in jet black surroundings, instead of being in the centre of a brilliantly illuminated thoroughfare. Part of this scheme includes an electric revolving table on which are mounted four "G.E.C." projectors, each equipped with 1,500-W gasfilled lamps. These are fitted with colour media. A view of the exterior is reproduced herewith. Over 8,500 "Osram" gasfilled lamps are employed in the scheme. Messrs. Griersons, Ltd., were the electrical contractors, and Mr. H. L. Carbuche, O.B.E., the architect.

"Mullard" Window Displays.

The MULLARD WIRELESS SERVICE CO., LTD., has designed three new window displays for the assistance of sellers of "Mullard" valves and loud-speakers. The one illustrated herewith is suitable for use in the largest size windows and is essentially a display for the "Pure Music" speaker, although it can be readily adapted for other of the company's products. Another display illustrates a classroom of novel character, the master and pupils being represented by valves seated before desks made of valve boxes. The other "fit-up" is more elaborate; it employs a large number of valves and has an attractive centrepiece. In each case a complete set of working instructions is provided.



A "Mullard" Window Display.

Development of the Ruths Accumulator.

A company styled Ruths Steam Accumulators, Ltd., has been formed to develop in this country the steam accumulator invented by Dr. Johannes Ruths, which was described in our issue of May 28th, 1926 (p. 807). The chairman is Mr. F. E. Powell (chairman of the Anglo-American Oil Co., Ltd.), and the other directors are Dr. Ruths, Mr. A. J. T. Taylor (managing director), Sir Alexander Kennedy (chairman of the Fairfield Shipbuilding Co.), Mr. J. B. E. Dahlerus (managing director of Electrolux), Mr. J. H. Hume (James Howden and Co.), and Mr. W. S. Eyre (Grace Bros.). The company will hold an exclusive licence for the sale of the Ruths accumulator in the British Empire.

Social Event.

The third annual fancy dress dance of the Dumbarton staff of the Electric Supply Corporation, Ltd., was held on December 23rd. A company of about 130 people in varied and novel costumes took part. The increasingly popular gathering added a further success to previous efforts. The hall was artistically decorated, the electrical illuminations being a special feature.

Electrical Exports of the United States.

We reproduce below some figures supplementary to those published in our last issue showing the comparative exports of telephone apparatus and locomotives from the United States during 1925 and 1926:—

	1925. Thous. $	1926. Thous. $	Inc. or dec. Thous. $
Telephones, magneto—			
Total	125	105	− 20
Telephones, other—			
Total	498	332	− 166
Telephone switchboards—			
Total	799	2,218	+1,419
Locomotives, electric railway—			
Total	482	1,841	+1,359
To Chile		301	+ 301
,, Cuba	107	29	− 78
,, Japan	52	928	+ 876
,, Mexico	112	—	− 112
,, Brazil	189	563	+ 374
Locomotives, electric, mining and industrial—			
Total	331	759	+ 428
To Chile	96	285	+ 189
,, Japan	27	45	+ 18
,, Mexico	44	85	+ 41
,, Australia	8	76	+ 68
,, British South Africa ...	68	27	− 61
,, Canada	27	26	− 1
,, Soviet Russia in Europe ...	—	133	+ 133

During October last the total value of electrical goods exported from the United States was $7,964,974, an increase of $144,214 as compared with the corresponding month of 1926, but $268,563 less than in September. The principal increases as compared with October, 1926, occurred in the case of the motor class: fractional h.p. motors rose in value from $151,417 to $210,884, motors of from 1 to 200 h.p. from $184,393 to $242,049, and accessories and parts for motors from $137,158 to $235,574. On the other hand, motors of over 200 h.p. fell from $119,493 to $27,509. The battery class also showed a substantial rise, the aggregate exports of the three items rising from $639,530 to $714,478. Other notable increases were:—Electric flashlamps from $138,083 to $203,479; sparking plugs, magnetos and other ignition apparatus, from $121,755 to $192,178; and domestic washing machines, from $73,420 to $109,750. Both insulated and bare copper cables recorded decreases—the former from $391,056 to $275,958 and the latter from $166,960 to $73,202. The radio apparatus section also showed a decrease—from $1,108,442 to $1,029,335—mainly due to the fall in exports of accessories. Other noteworthy decreases occurred in power transformers, from $209,301 to $62,702; switches and circuit breakers over 10 A, from $240,248 to $151,962; electric railway locomotives, from $244,341 to $184,032; carbon products, other than furnace electrodes, from $161,897 to $89,785; and unspecified apparatus, from $615,999 to $501,315.

Canada was by far the most important customer, her share being valued at $2,262,555, while Australia was second ($670,793), Brazil third ($554,436), and the United Kingdom fourth ($510,586).

The value of electrical goods imported into the United States during October was $250,806; of this, Germany accounted for $77,055, Japan $72,527, Sweden $50,230, and the United Kingdom $24,489.

The Brazilian Electrical Market.

Satisfactory sales of electrical equipment in several States of Brazil, with large prospective orders for radio equipment to be placed by the Federal Government, are reported. During the past year a new development in the market for electrical goods has taken place. Whereas this business was formerly carried on mainly by houses handling general lines of machinery, a number of foreign manufacturers, including some British, have established branches at Rio de Janeiro and other large towns where active business is done and large stocks are carried. On the other hand, a number of European manufacturers deal through native concerns only, the latter acting as exclusive representatives. For instance, Dutch manufacturers of electric lamps will only deal through their own resident representatives. Locally manufactured electrical goods have made little progress; consequently the prospects for these specialities from abroad appear to be particularly bright.—*Reuter's Trade Service* (Rio de Janeiro).

New Australian Company.

Dux Electric Heaters (South Australia), Ltd., has been formed in Adelaide with a capital of £45,000. It will acquire from Dux Electric Heaters (World Rights), Ltd., an exclusive licence for South Australia for the manufacture and sale of electric water-heating apparatus under the "Dux" patents.

Wages in the Engineering Industry.

The London District Committee of the engineering trade unions have sent to the respective national executives a request that the unions should prosecute a claim for an increase of 20s. per week for their London members.

Unemployment in Germany.

The latest figures of German unemployment furnished by the Berlin correspondent of *The Times* show that the number of persons in receipt of ordinary relief rose from 605,000 on December 1st to 831,000 on December 15th. At the same time, the number in receipt of extended benefits increased from 147,000 to 171,000, raising the approximate total from 750,000 to 1,000,000.

Municipal Trading in Australia.

The Melbourne *Argus* states that some time ago the State Electricity Commission opened two centres in country districts for the sale of electrical appliances, at the same time indicating that it was not proposed to extend these activities to the metropolitan area, and that even in the country it proposed to act largely as an agent for suppliers rather than as a competitor. Now, states our contemporary, the chairman of the Commission (Sir John Monash) has announced its desire to extend its sales operations to the metropolitan area, and has asked the Melbourne Electric Supply Co. to co-operate. Further, a number of municipalities have been approached with regard to the establishment of sales departments for electrical appliances. At least one of these has indicated that it will adopt the proposal if it can obtain the necessary amendment of the Local Government Act, while other municipalities are likely to do the same. Strong protests have been made by electrical traders, who maintain that the Commission's tactics are unfair, especially as this has happened so soon after the electrical exhibition in Melbourne upon which they spent a great deal of money.

Commercial Diplomatic Changes.

Owing to the resignation of Capt. U. de B. Charles, C.B.E., of the position of Commercial Secretary in Madrid, to take up a business appointment, a number of changes are being made in the Commercial Diplomatic Service. Mr. A. A. Adams, Commercial Secretary at Prague, will succeed Capt. Charles at Madrid; Mr. H. Kershaw, O.B.E., Commercial Secretary for Sweden and Denmark, will go to Prague; and Mr. W. Peters, lately Commercial Secretary at Moscow, will succeed Mr. Kershaw, with headquarters at Stockholm.

Recent Contracts.

The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has received orders for 367 electromagnetic automatic control equipments for motor coaches, and 194 control equipments for trailer coaches from the London Underground Railways. All the latest improvements are embodied in the design of these equipments which are operable with those supplied by the B.T.-H. Co. for the companies' 1920 rolling stock.

The ALTON BATTERY CO., LTD., has received an order for two batteries, each with a capacity of 10,005 Ah, for the new National automatic telephone exchange now in course of erection in London. These batteries, it is claimed, will be the largest in use in this country for telephone exchange work. The recently-opened Southport automatic exchanges are equipped with Alton batteries.

The Swiss Electrical Manufacturing Industry.

In an article contributed to the *Financial Times*, Mr. Hugh Quigley deals with the position and prospects of the Swiss electrical manufacturing industry. He shows, generally speaking, that up to the present the Swiss manufacturers have been able to rely upon orders placed by the Federal Railways to keep them employed. These have proved remunerative, for foreign competition was barred and a State subsidy was voted towards the electrification of the system. The secure home position permitted Swiss manufacturers to quote low export prices, but, with the almost immediate cessation of orders from the Federal Railways, they are faced with the necessity of raising their quotations or facing serious loss. The article concludes: "The future of the Swiss electrical industry must appear very difficult indeed, and the great exporting countries can scarcely regard with equanimity such a situation."

For Sale.

Mid-Cheshire Electricity Supply Co., Ltd., invites offers for surplus power station plant. Liverpool Corporation Electric Supply Department has for disposal a number of second-hand d.c. motors and starting switches. Messrs. Fulley, Horsey, Sons & Cassell invite offers for one 300-kW generating set. Monmouthshire Training College, Caerleon, has for disposal a surplus electrical generating set consisting of gas engine and dynamo, &c. Eastbourne Corporation Electricity Department invites offers for one 750-kW turbo-alternator condenser, water-tube boiler, &c. Mr. H. J. Shaw will sell by auction, on January 11th and 12th, at 129, Newington Causeway, S.E.1, stocks of electrical and wireless material, &c. (See our advertisement pages to-day.)

Unemployment.

There was a decrease of 25,320 in the number of registered unemployed during the week ended December 19th. At that date the total was 1,099,900, as compared with 1,125,223 a week earlier and with 1,309,739 on December 20th, 1926.

Calendars and Diaries.

CALLENDER'S CABLE & CONSTRUCTION CO., LTD., have issued a large summer time coloured view of the Victoria Embankment, showing the Military Guard for the Bank of England passing Hamilton House, the company's offices.

"The Old Kitchen Chair" (Thomas Ladell) is the subject of the picture on the calendar of the LANCASHIRE UNITED TRANSPORT & POWER CO., LTD. Suspended monthly slips are provided.

Mr. FERNAND ESPIR, 86-88, Queen Victoria Street, E.C.4, has sent us a refill of polyglot date slips for his desk calendar.

MESSRS. ERNEST F. MOY, LTD., Greenland Place, Camden Town, N.W.1, depict a large switchboard installation on their 1928 calendar.

The series of Mersey pictures is continued by the LIVERPOOL ELECTRIC CABLE CO., LTD., Linacre Lane, Bootle. The subject of the 1928 drawing is "H.M.S. *Rodney* passing Gladstone Dock, Liverpool." The calendar has neat grey monthly date sheets.

A very large wall calendar with bold figuring has reached us from Messrs. G. & T. EARLE (1925), LTD., cement manufacturers, Hull. An unusual feature of this is that it has monthly sheets for three years.

The UNIVERSAL ELECTRIC LAMP CO., 89, Great Eastern Street, E.C.2, has sent us a wall calendar with monthly sheets.

The LEA RECORDER CO., LTD., of 28, Deansgate, Manchester, has produced a desk calendar or appointment pad for 1928, with a page of spaces for every six-day working week.

From the DUSSEK BITUMEN CO., LTD., Bromley-by-Bow, E.3, we have as usual received a handsome pocket diary in black and gold, with insurance coupon.

Messrs. JOHNSON & PHILLIPS, LTD., have again sent us one of their blotting pads with date indicator and book diary. This is a most useful desk companion, and the well-known monogram of the donors greets us daily throughout the year.

A refill for its "Sunco" desk calendar has been received from the SUN ELECTRICAL CO., LTD.

The MAXIM LAMP WORKS (Poynter, Griffiths & Co., Ltd.), 75, Canonbury Road, N.1, again employs the picture of a pretty girl to illuminate its calendar; quarterly date slips are provided.

A garden calendar has been sent to their friends by Messrs. EVERSHED & VIGNOLES, LTD. Each monthly sheet has a photographic view of a horticultural scene reproduced from *Amateur Gardening*.

The telephone card of the COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD., has arrived as usual.

Messrs. HILDICK & HILDICK, Walsall, have sent us a neat wall calendar comprising a representation of a bunch of screwed tubes and a block of daily slips.

A neat little calendar with a block of large date slips has reached us from Mr. SAMUEL BAXTER, 102, Greyhound Road, W.C.

The usual design, but with a change of colour, is employed for the 1928 calendar of the DAVENPORT ENGINEERING CO., LTD., Bradford. This illustrates the company's cooling towers, and has a block of daily slips.

The calendar received from the BRITISH BROWN-BOVERI, LTD., is of chaste design. Each of the monthly sheets bears a photogravure view of parts of Switzerland in which Brown-Boveri plant is in use.

The calendar issued by POPE'S ELECTRIC LAMP CO., LTD., is of the wall type, with boldly-figured monthly date sheets.

Messrs. W. H. WILLCOX & CO., LTD., 38, Southwark Street, S.E.1, have sent us a calendar with monthly sheets bearing illustrations of their products.

The calendar sent by SIEMENS-SCHUCKERT (GREAT BRITAIN), LTD., strikes a distinctive note. For each month there is a picture typifying some phase of the company's activities, and there is a block of daily slips.

The 1928 calendar of the ENGLISH ELECTRIC CO., LTD., is of simple design, with a block of daily slips.

Trade Announcements.

Messrs. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2, are making a special New Year offer to retailers of 500 sets of "Universal" vacuum cleaners and floor polishers, with accessories. With the offer are particulars of a hiring service for the two machines.

Mr. A. R. HOMES, electrical and wireless engineer, is opening new premises at 46, Botolph Street, Norwich, and he asks for catalogues.

The name of DIAMOND COAL-CUTTER CO., LTD., has been changed to BRITISH JEFFREY DIAMOND, LTD. The business of the company will be continued as heretofore.

Messrs. A. H. HUNT, LTD., Croydon, have produced a smaller carton for their insulating tape. This holds a dozen tins, and is suitable for trade counter display.

Messrs. GALLOWAY, LTD., Manchester, have acquired the goodwill, patterns and drawings of Messrs. John Musgrave and Sons, Ltd., Bolton, including the drawings of engines formerly made by Messrs. John & Edward Wood, Bolton.

New Catalogues and Lists.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram Bulletin" for January containing several well-illustrated articles on lighting schemes carried out with the company's equipment, including the floodlighting of Liberty's, Regent Street, W., and a boot factory in South Africa. The "Osram" "K" type valves are dealt with in an illustrated article, and there are other notes upon the company's radio and domestic electrical equipment.

NEWTONS OF TAUNTON, 224, Shaftesbury Avenue, W.C.2.—A priced and illustrated publication dealing with motor-generators specially designed for kinematograph work. Also an illustrated pamphlet containing an abridged specification, details and prices of two- and three-phase induction motors.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Leaflets P.227, dealing with "Prescot" fuse wires, and P.228, with "Prescot" foundry paint.

THE DUSSEK BITUMEN CO., LTD., Empress Wharf, Bromley-by-Bow, E.3.—Two pamphlets—one dealing with "Nozzet" plastic cement for frames, covers, manholes, &c., and the other with "Trinidite" insulating compound, with details of tests.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—A January calendar-blotter, advertising "Elasta" lamps.

THE LIVERPOOL ELECTRIC CABLE CO., LTD., Linacre Lane, Bootle, Liverpool.—An illustrated brochure describing the company's "Lecite" wiring system.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Publication No. 4117/7, illustrating and describing "Cosmos" resistance coupling and detector units for ordinary and a.c. valves. Priced. Brochure No. 7,117/9, containing a fully-illustrated description of the "Met-Vick" five-valve mains-operated radio receiving set.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—January price list of electric lighting fittings, "Bull" motors, &c., vacuum cleaners, electric fires, and other electrical supplies. Illustrated

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—Price List 42/1, briefly describing the company's flameproof switches and fuses for 10 A at 250 V. Illustrated. Also a January calendar-blotter advertising the company's troughed belt coal conveyor for use in mines.

MESSRS. JOHN LAWTON & SON, LTD., 30-33, Harford Street, Birmingham.—A priced and illustrated catalogue of lamp-holders of various patterns and finishes.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—Pamphlet No. 187, illustrating and describing weatherproof plug boxes with switches and fuses (up to 600 V).

THE UNITED ELECTRICAL CO. (BIRMINGHAM), LTD., Caroline Street, Birmingham.—A priced and illustrated pamphlet dealing with "Coolex" ironclad switches and fuses.

Catalogues Wanted.

Manufacturers of electrical fittings, heating and cooking appliances, &c., are asked to forward catalogues and lists to the Electrical Showroom Superintendent, Corporation Street, Lincoln.

Bankruptcy Proceedings.

W. HANNA, wireless dealer, 13, Carey Street, Burnley.—First and final dividend of 2s. 5½d. in the £, payable at the Official Receiver's office, 9, Cannon Street, Preston.

Company Liquidations.

BOLLING & LOWE, LTD.—Winding up voluntarily by special resolution under Section 69 of the Companies (Consolidation) Act. Liquidator, Mr. J. A. Campbell, 16-17, South Street, E.C.2.

SPRAGUE ELEVATOR CO., LTD.—Winding up voluntarily. Liquidator, Mr. M. Lancaster, 46, Basinghall Street, E.C.

The Buenos Aires Subway Scheme.

According to the *Review of the River Plate*, the settlement of the question of the construction of new subways in Argentina is being delayed by political considerations. The Anglo-Argentine Tramways Co., Ltd., which holds the concession for the construction of the subways, insists that it cannot proceed until higher fares are sanctioned. In view of the forthcoming presidential elections the parties forming the Municipal Council hesitate to approve higher fares.

In the meantime, *Reuter* reports that the Municipality has now definitely rejected the scheme put forward by a London group headed by Lord Ampthill.

Proposed Australian Radio Manufacturers' Association.

The *Daily Guardian* (Sydney) reports that Australian manufacturers are becoming alarmed at the dumping of American sets upon the Commonwealth market at considerably under cost price. A meeting of Sydney radio manufacturers was held recently, and steps are being taken to form an Australian Radio Manufacturers' Association, with the main idea of protecting the home radio industry.

New German Company.

A new concern has been formed in Berlin, with the title Die Preussische Elektricitäts Gesellschaft, to group the financial interests of the Main-Weser Electric Power Supply Co., the Ober-Weser Co., and the Hanover electricity supply undertaking.

Book Notices.

A special sectional catalogue of technical books in radio engineering, telegraphy, and telephony has been issued by the McGraw-Hill Publishing Co., Ltd., giving full particulars and prices of five-and-twenty works on these subjects.

"Technologic Papers of the U.S.A. Bureau of Standards." No. 351, "Practical applications of the earth-current meter." (20 cents.)

"The M. & C. Apprentices' Magazine." Christmas Number, 1927. Glasgow: Mavor & Coulson, Ltd.—This journal is, as usual, very well produced, and contains illustrated articles of domestic and wider interest.

"Cable and Wireless Communications of the World," by F. J. Brown. Pp. ix+148; illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

Proposed Belgian-Lithuanian Company.

Negotiations are reported to be in progress in Brussels having for their object the formation of the Compagnie Belge-Lithuanienne d'Electricité, to establish power stations for the supply and distribution of electrical energy in Lithuania.

New Mavor & Coulson Works.

The new works of Messrs. Mavor & Coulson, Ltd., at East Kilbride, about 10 miles from Glasgow, are rapidly approaching completion. It is expected that they will be in full production early in the New Year.

Electricity in a Scottish Bank.

The new headquarters of the Union Bank of Scotland, Glasgow, was opened on December 27th. The building, which is of eight storeys, is thoroughly equipped electrically. There are nine electric operated lifts by Waygood-Otis, Ltd. The central vacuum cleaning, ventilating and printing plants are also electrically operated. The "Dictagraph" telephone system is installed throughout, as well as an extensive system of P.O. telephones. The clocks are electrically operated on the "Synchronome" system. The installation involved the use of about 10 miles of steel tubing and 30 miles of electric cable. Energy is received from the Glasgow Corporation Electricity Department at 6,600 V, and is stepped down by two 200-kVA transformers to 250 V for lighting, heating, and cooking, and to 440 V for the motors. In the banking hall are 21 alabaster globes, each of 30 in. diameter. Over 9,000 lamps are used in the building. The complete installation was carried out by Messrs. Kennedy, Stark & Co., electrical contractors, Glasgow, to the specification and under the supervision of Messrs. James E. Sayers & Co., consulting engineers, Glasgow. Barr's pneumatic cleaning system is installed. It consists of an electrically-driven turbine placed in the basement with piping led throughout the premises. Among other contractors were: Messrs. Ashwell & Nesbitt, Ltd., heating, &c., engineers; Barr & Co., vacuum cleaning plant; Russell and Co. (Engineers), Ltd., electric lighting fittings.

New Equipment for Sunderland Docks.

The River Wear Commissioners at Sunderland have decided to install four 5-ton luffing electric cranes, with grabs, at an estimated cost of £16,080, for the Hudson Dock East Quay at the Sunderland South Docks. They will also remove the four electric cranes at present in use at this quay to the Hendon Dock East Quay, which will be electrically equipped. The cost of this part of the scheme is estimated at £2,500.

Prices of Raw Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, January 3rd:—No change in copper prices.

Messrs. James & Shakespeare report, January 3rd:—Lead, English pig, £23 15s., 5s. inc.

Messrs. Edward Till & Co. report, January 3rd—No change in the price of India-rubber, Para fine.

Lighting and Power Notes.

Bedford.—ELECTRICITY SUPPLY.—The Electricity Commissioners have suggested that the Rural District Council should withdraw its opposition to the use of overhead mains by the Rushden and District Electricity Supply Co., Ltd., for the supply of electricity to the parishes of Harrold, Odell, and Wymington. The Council has appointed a committee to go into the matter with a view to obtaining better terms from the company.

Belgian Congo.—ELECTRICAL DEVELOPMENT.—The Société Textile Africaine is carrying through an ambitious programme in the Belgian Congo. The concern has not only acquired a large area of land between Kinshasha and Leopoldville for cotton growing purposes, but is also establishing a cotton ginning plant, a large spinning and weaving mill, a hotel for the officials, and a garden city for the workers. The machinery of the spinning and weaving mill is to be electrically operated, and, pending the establishment of a hydro-electric station by an affiliated concern, the Société Coloniale d'Electricité, the necessary power is to be supplied by a temporary steam-operated generating station using timber from local forests as fuel. There are several important falls on the River Inkisi, which are to be utilised by the latter company, particularly the Sanga Falls, about 15 miles from Madimba, where a dam is to be constructed and a generating plant with an initial capacity of 10,000 kW is to be installed. Electricity will be transmitted from Sanga to Leopoldville, a distance of over 60 miles.

Brigg.—ELECTRICITY SUPPLY.—In reply to a letter regarding the proposed electricity schemes for Lincolnshire, the Rural District Council has been advised by the County Council to defer pledging itself to support any particular scheme until the matter has been discussed by other authorities at a proposed conference which will be called as soon as more information is available. According to the *Yorkshire Post*, the County Council points out that there are at least three parties seeking to supply electricity in Lincolnshire—the Lincolnshire Power Co., the Yorkshire Electric Power Co., and the Public Utility Service Co. and the County Authority.

Canada. — HYDRO-ELECTRIC DEVELOPMENT. — The Hydro-Electric Power Commission of Ontario is negotiating with the Gatineau Power Company for an additional supply of 100,000 h.p. The contract calls for 60,000 h.p. to be delivered in blocks of 6,000 h.p. per annum for a ten-year period, and also stipulates that an additional 40,000 h.p. can be had if required. The price to be paid is stated to be $15 per horse-power. The power will be developed at the new plant at Chelsea, Quebec, a few miles north of Ottawa, on the Gatineau River, and is to be delivered to the Ontario Hydro-Electric Power Commission for distribution in Eastern Ontario in the neighbourhood of Ottawa. Current will be distributed over 100,000-V lines erected in duplicate. The previous contract of the Ontario Hydro-Electric Power Commission with the Gatineau Power Company called for the delivery of a maximum of 260,000 h.p., and transmission lines are now being erected to carry this power to Toronto, a distance of more than 200 miles from Paugan Falls on the Gatineau River, at a pressure of 220,000 V.

Cheltenham.—ELECTRICITY IN BULK.—The Corporation Electricity Committee has arranged bulk supply terms with the Shropshire, Worcestershire and Staffordshire Power Co., Ltd., for a period of 10 years.

Clayton.—ELECTRICITY SUPPLY.—The Urban District Council last week began the supply of electricity in its area. The current is taken in bulk from the Yorkshire Electric Power Co. At present there are about a hundred consumers, but it is expected that this number will shortly be substantially augmented.

Cleethorpes.—ELECTRICITY DEPARTMENT REORGANISATION.—According to the *Grimsby Daily Telegraph*, in view of recent developments, the Electricity Department of the Urban District Council is to be reorganised. A sub-committee has been considering the matter, and its recommendations were laid before the Council on December 21st. As a result, the appointment of Mr. Swarbrick as the consulting electrical engineer will terminate on March 4th next, and a whole-time electrical engineer will be appointed. Matters concerning the remainder of the staff are being left for consideration until after the electrical engineer has taken up his duties.

Continental.—RUMANIA.—According to a recent official return there are now 146 power stations in operation in Rumania. Of the total, 31 plants are hydro-electric, 44 are steam-operated, and 71 utilise internal-combustion engines. The total installed capacity is about 174,300 kW.

FRANCE.—The report of the Société Nantaise d'Eclairage et de Force pour l'Electricité, of Nantes, for the last financial year states that, as the result of the completion of a new transmission line between Nantes and Cholet, the company has now the advantage of a duplicate supply system for the Cholet district. Work has also been completed on a rural distribution system to 92 villages in Loire-Inférieure, while a contract has been entered into to supply 35 villages in Maine-et-Loire.

CORSICA.—La Société Meridionale d'Eclairage et de Force has secured a concession to supply electricity to 29 communes on the Island of Corsica.

Culcheth (near Leigh).—INAUGURATION OF SUPPLY.—An electricity supply for the district was recently formally inaugurated. Electricity is supplied by the Lancashire Electric Power Co. at a pressure of 3,300 V a.c., and is reduced to 230 V for lighting and 400 V for power.

Dover.—ELECTRICITY SUPPLY.—In accordance with instructions the borough electrical engineer has prepared a report on a proposal to supply electricity to small houses. He states that it would be possible to obtain a considerable revenue from a row of small houses if the supply could be given at no initial cost to the householders and the energy supplied through prepayment meters. A street where the blocks of houses were close together and facilities were offered for carrying overhead cables along the wall above the top windows and close under the eaves lent itself to a cheap supply as a connection could be made from the overhead wires to a prepayment meter, and four light points wired in the house at

a price not exceeding the present cost of a service line, if laid underground and on the supposition that a separate cable were laid to each house. A loan could be obtained for free wiring, repayable in 10 years, but to carry out such an arrangement as proposed it would be necessary to obtain the consent of the landlords and tenants in every house in the street. The Electricity Committee has instructed the engineer to carry out the scheme in a selected street as an experimental measure.

Dunoon.—ELECTRICITY SUPPLY.—As a result of an interview which a deputation from the Town Council has had with the Electricity Commissioners, it is expected that the town will receive a supply of electricity from Greenock by a cable across the Firth of Clyde within the next six months.

Egypt.—ELECTRICAL DEVELOPMENT.—Negotiations are reported to be in progress in connection with the establishment of a new power station by the Société des Tramways du Caire, with the object of supplying electrical energy to Heliopolis in place of the existing small station in that town.

Hull.—ELECTRICITY SUPPLY.—The Corporation has been approached by the L.N.E.R. Co. with a view to a complete change in the system of electricity supply by the former. The scheme is an important one, and involves a much larger supply of electricity to the company, including the connecting up of the company's docks.

Llandudno.—PROPOSED CHANGE-OVER.—The Urban District Council has received a report from its consulting engineer regarding the proposal to change over the system of electricity supply from d.c. to a.c. The estimated cost of the scheme is £19,500, and it is to be discussed at a special meeting of the Council.

Lytham-St. Annes.—EXTENSION OF SUPPLY.—The Electricity and Tramways Committee has recommended the Town Council to approve a scheme for the extension of a supply of electricity to Warton and Freckleton.

Maidstone.—POWER STATION FLOODED.—As a result of the overflowing of the Upper Medway, the town was flooded on December 26th. *The Times* reports that at the Corporation electricity supply station the rise of the water was checked by pumping until late in the afternoon, two fire engines being used, but then the flood gained the upper hand, the tramway services were stopped, and the town, except for those portions lit by gas, was plunged into darkness. Places of amusement in the town had to close down and many business premises and warehouses were inundated.

Northern Ireland.—DONAGHADEE.—An electricity supply for the district, the contract for which is in the hands of the Donaghadee Electric Light and Power Co., was recently formally inaugurated by the chairman of the Urban District Council. The plant includes two crude-oil engines and two generators of 40 kW and 14 kW respectively. The charges for electricity are 10d. per kWh for lighting and 5d. per kWh for power.

Rotherham.—NEW RECTIFIER.—In connection with the supply of electricity for the Mexborough and Swinton railless-car system, the Corporation Tramways Committee has authorised the installation of a 300-kW Hewittic rectifier, at an estimated cost of £1,800.

Seaham Harbour.—LOANS.—The Urban District Council Electricity Committee is seeking sanction to the following loans:—£1,700 for poles, cables, &c.; £1,000 for services; and £500 for meters.

Sheffield.—MAINS EXTENSIONS.—During the past month the Corporation Electric Supply Committee has approved mains extensions at a cost of £10,346.

PRICE REDUCTIONS.—The following reductions have been made in the charges for electricity:—All energy charged at 2d. per kWh or under: From 30 per cent. to 10 per cent., above the basic rate. All energy over 2d. per kWh: From 15 per cent. to 5 per cent. above the basic rate.

Southend-on-Sea.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £6,262 in respect of a balance required for the installation of a 300-kW set at Thorpe Bay, and three 750-kW sets at London Road and Leigh stations, and £12,000 for services.

ELECTRICITY CHARGES.—From the New Year electricity is being supplied to places of worship at 5d. per kWh, a reduction of ¾d. per kWh.

LOAN.—The Council has applied for sanction to a loan of £12,000 for mains.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Yorkshire Electric Power Co., authorising it to supply electricity in the urban district of Crowle, the rural districts of Isle of Axholme and Misterton, and part of the rural district of Gainsborough, and the General Estates Co., Ltd., to supply electricity in the parish of Dibden in the New Forest rural district.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Power Development Co., Ltd., to supply electricity in the urban district of Yeardsley-cum-Whaley, the rural districts of Chapel-en-le-Frith and Disley, and part of the rural district of Macclesfield, and the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., to acquire lands in the parish of Little Barford for the erection of a generating station.

United States.—ELECTRICAL DEVELOPMENT.—According to *Power*, construction by subsidiary affiliated companies of the Standard Gas and Electric Company, now under way or authorised for immediate installation, will add a total of more than 270,000 kW of generating capacity to the resources of these companies, according to the Byllesby Engineering and Management Corporation, in charge of engineering and construction. Upon completion of the work mentioned, the combined generating facilities of companies in the Standard system will total more than 1,340,000 kW. The Duquesne Light Company, Pittsburgh, has completed the installation of one 40,000-kW turbine at the Colfax station, and a second unit of the same size is reported ready for service. Louisville Hydro-Electric Company is completing the construction of a hydro-electric plant, with installed capacity of 80,000 kW, at the Falls of the Ohio River, at Louisville. The first 10,000-kW unit of the 48,000-kW Prospect No. 2 development of the California Oregon Power Company, under construction on the north fork of the Rogue River, in Oregon, is nearing completion, and a second unit of the same capacity will be added early this year. Oklahoma Gas and Electric Company is to extend its Harrah steam-electric station near Oklahoma City, and will install an additional turbine of 30,000 kW. Two additional boilers are being installed. Harrah, upon completion of the work now in progress, will have a total capacity of 65,000 kW.

West Midlands.—ELECTRICITY SCHEME.—The West Midland Joint Electricity Authority took over, on December 30th the generating stations of the Wolverhampton, Walsall, and West Bromwich Corporations and the Tipton station of the Midland Electric Corporation for Power Distribution. The *Daily Telegraph* states that an initial payment of £1,000,000 was made to the authorities concerned. Intercommunication of the stations will not be completed for from eight to twelve months, and the balance of the purchase price will be paid when the exact figure has been ascertained.

Tramway and Railway Notes.

Australia.—VICTORIA.—According to the *Industriai Australian and Mining Standard* the Victorian Railway Commissioners made investigations about two years ago into the prospects of electrification of certain country lines near Melbourne, and statements were made that the congested Warragul and Geelong lines would probably be electrified in the near future. The Commissioners have, however, now decided that, for a time at least, other methods shall be used to increase the capacity of the country lines—such methods include improved signalling and train control. A decrease in country passenger traffic, owing partly to competition of motor cars, and the low density of traffic, have been partly responsible for the Commissioners' decision to postpone further electrification. A number of electric locomotives are being built, however, for handling goods trains on the lines already electrified.

Bolton.—TRACK RENEWALS.—The Corporation Tramways Committee has decided to proceed with the relaying of the tramway track in Great Lever Road.

Bradford. — PROPOSED RAILWAY ELECTRIFICATION. — The Transport Committee of the Bradford Chamber of Commerce has suggested that Bradford should be linked up to Leeds by an electrified railway with a 15 minutes' service, and doing the journey in 15 minutes, as against 30 to 45 minutes at present.

Continental. — BELGIUM. — The Société Nationale des Chemins de Fer Vicinaux, of Brussels, has placed contracts for the extension of the local electric railway between Ostend and Westende to Lombartzijde and Nieuport, and for the doubling of the line between Nieuport and La Panne.

HOLLAND.—Good progress has been made with the work of electrifying the Dutch railways and electric trains are now running between Rotterdam, The Hague, and Amsterdam, a distance of about 53 miles, and on the eight-mile branch line between Haarlem and Ymuiden. Although no definite decision has been made known, it is understood that the railway authorities will next proceed with the electrification of the line between Amsterdam and Amersfort.

SPAIN.—A concession has been granted for the construction of an electric tramway in the town of Sabadell.

Glossop.—TRAMWAY SERVICE SUSPENDED.—The Urban Electric Supply Company has closed down its tramway system between Glossop and Hadfield, which has operated for about 24 years. The system was offered free to the Corporation on condition that the company supplied the power, but the Town Council has decided to adjourn for the time being the question of acquiring both the local tramway and electricity undertakings.

Japan.—RAILWAY ELECTRIFICATION.—It is reported that the railway authorities have under consideration a proposal to electrify the Joyetsu line. For this purpose 36 locomotives will be required, the estimated cost of each being 200,000 yen.

It has been decided to electrify the Saga Manure Co.'s horse tramway and light railway and to extend the present lines, increasing the capital from 190,000 yen to 1,200,000 yen, under the new name of the Saga Electric Railway Co., Ltd.

NEW ELECTRIC RAILWAYS.—It is understood that a scheme for the construction of an electric railway in Aichi Prefecture is under consideration. The scheme includes the laying of 43 miles of track, and the erection of 13 sub-stations. The voltage will be 1,500.

The Sanshin Railway Co. has been formed with the object of laying an electric railway of 43 miles between the Ina Railway and the Horaiji Railway.

TOKIO.—The first underground railway in the Far East was opened to the public on December 30th. It has been constructed on the pattern of the New York system and is to be earthquake-proof. At present the railway is 1¼ miles in length and connects the important railway terminus of Ueno with the pleasure quarter of Asakusa. It will, however, eventually be extended for nine miles westwards into the suburbs. —*Reuter* (Tokio).

Telegraph and Telephone Notes.

Corsica.—TELEGRAPH SERVICE.—The Chamber of Commerce of Ajaccio considers that the two existing cables between Corsica and France have become insufficient, and is urging the French Government to lay another combined telegraph and telephone cable between the island and the mainland.

International Telephony.—DEVELOPMENTS IN FRANCE.—Long-distance underground-cable telephony in France has much improved, greatly reducing the call-delay period, and an active policy of development in collaboration with foreign countries has put Paris in easy communication with most large European cities. The distance over which conversation is possible has almost doubled since the war, and *The Times* estimates that an average of 13,000 incoming and outgoing international calls are dealt with daily in France. There are at present 290 overhead telephone circuits directly connected with other countries, having a total length of some 13,750 miles. The Paris-Nancy-Strasbourg underground cable alone carries 40 international circuits, linking France with Germany and Switzerland. The Scandinavian countries are in direct communication with Paris. A telephone call was recently received in Paris from Lulea, a little Swedish town 70 miles from the Finnish frontier, *via* Stockholm and Berlin, a distance of about 2,280 miles. The two submarine cables between Germany and Sweden, laid in 1919 and 1921, have been found insufficient to meet present traffic, and another will be put into operation in the course of the next few months. The new cable leaves the German coast near Zarrenzin, is beached in the Bay of Kaempinge, Sweden, and passes through the amplifying station at Malmö to Stockholm. The excellent Paris-London service will be further improved when the new cable *via* Boulogne is opened early in 1928. Present cables have a capacity of 16 circuits, but this number will be increased to 29 when the new cable is in use.

NEW ANGLO-CONTINENTAL SERVICES.—The British Postmaster-General announces that telephone services were inaugurated between England and Czecho-Slovakia and Hungary on January 1st, 1928, communication being available from all parts of Great Britain, but will be restricted initially to calls to Prague and Budapest. The service zones are the same as for other Anglo-Continental services.

RUSSIA.—The Soviet Government has decided to postpone indefinitely the opening of the Moscow-Berlin telephone service, although all technical preparations are complete, on account of the refusal of the German authorities to accord Soviet trading agencies the privileges enjoyed by diplomatic officials, says *The Times*.

Philippine Islands.—LONG-DISTANCE TELEPHONY.—A Bill has been introduced in the Senate providing for a franchise, for a term of 50 years, to the Philippine Long-distance Telephone Co., to connect the various telephone systems now existing in several points in the archipelago. There are at present five telephone companies in the Islands. It is proposed to start the project by constructing a radio-telephone line between Manila and Baguio, and gradually to link together the provinces and municipalities in the island of Luzon. Eventually, connection between points in Luzon, the Visayas, and Mindanao will be established by means of cable lines. An American company, it is reported by the *T. & T. Age*, will finance the project.

Portugal.—TELEPHONE CONTRACT.—The Cabinet has approved of the principal clauses of an agreement for the renewal of the State contract with the Telephone Company.—*Reuter* (Lisbon).

The Telephone Service.—EXCHANGES.—There are now nearly 4,200 telephone exchanges in this country, and about 63,500 private branch exchanges. The number of public kiosks in the provinces exceeds 3,000.

Radio Notes.

Empire Broadcasting.—AUSTRALIA.—After a remarkable week of relaying through the Sydney station (2FC) every night between 10.30 and 11.30 p.m., when people throughout the State listened and danced to music from London, Christmas morning's re-broadcast was disappointing owing to the unsuitable hour—1.15 to 2 a.m.—*Reuter* (Sydney).

MAURITIUS.—Christmas greetings from the British Broadcasting Corporation were easily heard in Mauritius at 10 p.m. on December 25th. Listeners also heard Australia on the same night.—*Reuter* (Port Louis).

Italy.—STATE CONTROL.—The Department of Overseas Trade learns from a reliable source that Royal Decree Law No. 2,539/2,207, dated November 17th, 1927, published in the Rome *Gazzetta Ufficiale*, No. 287, of December 13th, contains new regulations for the purpose of improving and developing broadcasting services in Italy. The measure provides for the institution of a higher committee of control at the Ministry of Communications, amends the conditions under which concessionary rights are granted, revises the charges for licences, and provides for special subscription rates for communes, organisations, and private individuals.

Licences.—YEAR'S INCREASE.—The number of broadcast radio-telephone receiving licences in force in Great Britain at the end of November, 1927, was 2,366,520, compared with 2,178,259 on December 31st, 1926.

Regional Broadcasting.—5GB TESTS.—The B.B.C. has issued an interim report on the tests which have been carried out at the Daventry experimental station (5GB) during the past four months of working; it is as follows:—When the station replaced the local Birmingham transmitter in August, 1927, a single low aerial was installed, but after a short trial it was found that the fulfilment of one of the main objects of the new station, namely, the provision of an adequate signal for Birmingham, could not be guaranteed. The reason was that shielding occurred from the masts of the long-range Daventry station (5XX), and therefore a second low aerial was erected in parallel to the first, designed to radiate in the Birmingham direction, considerable improvement being effected in the signal strength from the double aerial over the Birmingham area. Having in mind the provision of data in connection with the scheme of regional stations, the B.B.C. proceeded to erect masts, 300 ft. high, which it was thought might ultimately replace the low double masts; experiments have recently been carried out with the new masts, but it appears that the shielding effect in the Birmingham direction is likely to be accentuated by their use. The next step, therefore, will be to rearrange the 300-ft. masts in such a way as to maintain the present signal strength in Birmingham, while giving greater all-round strength to that portion of the rest of the country which is within range of 5GB. Until it is possible to guarantee that the field strength in Birmingham from the higher aerial is on its lowest terms as great as it is to-day, the 300-ft. masts will not be brought into regular service. The general efficiency of the new aerial has been definitely proved to be greater than that of the twin aerial at present functioning, and the experiments for which it is adapted will be of ultimate value in connection with the regional scheme.

World Broadcasting.—1,116 STATIONS.—Mr. L. D. Batson, of the Electrical Equipment Division of the U.S. Department of Commerce, points out in the *T. & T. Age* that radio-telephone broadcasting services are now provided by 431 stations in 57 foreign countries, in addition to the 685 operating in the United States and its non-contiguous territories: Europe has 195; North America outside the United States, 128; South America, 52; Asia, 18; Oceania, 28; and Africa 9. The division of stations by countries gives Canada 59; Cuba, 47; Russia, 38; Sweden, 30; Australia and Germany each, 24; Argentina, 22; United Kingdom, 20; France and Mexico each, 18; Spain, 15; Brazil, 12; Chile, 9; Finland, 7; Switzerland, 6; and Austria, 5. There are four each in Belgium, Czecho-Slovakia, Uruguay, India, Netherlands East Indies, and New Zealand; three each in Italy, Poland, China, Japan, and South Africa; two each in Denmark, Estonia, Hungary, Irish Free State, Norway, Portugal, Bolivia, and Algeria; and one each in Iceland, Latvia, Lithuania, Luxemburg, Netherlands, Turkey, Yugo-Slavia, Costa Rica, Haiti, Paraguay, Peru, Venezuela, Ceylon, Chosen, Kwangtung, Straits Settlements, Canary Islands, Egypt, Morocco and Tunisia.

Outside the United States, the most powerful broadcasting stations are those at Motala (Sweden) and Moscow (Russia), having 40,000 watts each; Russia also has a 29,000-watt station at Moscow, and one of 10,000 watts at Leningrad. Daventry (England) operates on 16,000 watts. A station of power ranking above 40,000 watts is reported to be under construction in the Netherlands. The ownership of 34 broadcasting stations has not been reported; Governments own and operate 77 stations; associations and institutions, 87; commercial and industrial establishments, 69; broadcasting companies, 127; and private citizens, 33. Of the Government stations, two are municipal, 16 provincial, and 59 national, the latter being subdivided into 33 operated by ministries of communication, two by ministries of education, and four by

ministries of war, the 20 stations in the United Kingdom being administered by an independent government broadcasting commission.

Radio organisations operate 65 of the 87 stations in the organisation group; church organisations, 6; and educational institutions, 5. Aviation, political, military, radio merchants' and theosophical societies operate the remainder. Merchants, mostly electrical and radio, have 35 stations, manufacturers maintaining 5. The stations operated by publishers number 15, most of them newspapers; by railways, 3; and grain dealers and farmers' co-operatives, 2 each; telephone companies, hotels, sales agents, theatres, and power companies are represented by a single station each.

Radio amateurs account for the largest group, with 40 stations. Nation-wide chains include 29 stations, 21 of them being owned by companies holding national broadcasting monopolies. Local broadcasting companies each operating a single station number 31. Regional monopolies with exclusive broadcasting rights in only a limited part of the country own 27. Private citizens control 33; in a sense these are of the amateur class, though their stations are of the broadcasting classification. Fifteen broadcasters have part-time use of stations owned by other organisations. Four of these are church organisations, one a radio society, two are publishers, and one a railway, the latter having arrangements with eight stations in different cities.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Army Contracts.—Manufacturers who are not already on any War Office list of tenderers, and who may wish to be invited to tender for Army requirements of electrical stores, cables, scientific instruments, &c., should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, S.W.1, for Form 1, on which formal application for inclusion on the list of tenderers may be made. (See this issue.)

Ashford (Kent).—Electricity Department. Diesel type solid injection oil engine, direct-coupled to 500 to 600-kW alternator. (See this issue.)

Australia. — SYDNEY.—February 1st. New South Wales Government Railways. One 3,000-kW rotary-convertor unit for Hornsby sub-station, and one ditto for St. Leonards sub-station. Chief Electrical Engineer, 61, Hunter Street, Sydney.

February 29th. One 15-ton, 3-motor electric overhead travelling crane, span 85 feet, for the Chullora electric car repair shops. Chief mechanical engineer, Wilson Street, Redfern, Sydney.

MELBOURNE.—February 22nd. Victorian Railways. Electric butt-welding machine. (B.X. 4095.)*

March 7th. City Council. D.c. switchgear and accessories. (B.X. 4100.)* 6,600-V switchgear. (B.X. 4101.)*

March 7th. Two 2,500-kW motor convertors and accessories, or, alternatively, two 2,500 rotary convertors with transformers, &c. (B.X. 4104.)*

February 21st. Postmaster-General's Department. Bells and buzzers. (B.X. 4084.)*

February 28th. Condensers. (B.X. 4089.)* Test desks for auto exchanges. (B.X. 4090.)*

Ayrshire.—Education Authority. Electric lighting installation at new clinic, extension to Doune Public School, and extension to Annbank Public School. Schedules from Mr. W. Reid, Master of Works, Education Offices, Ayr.

Birmingham.—January 9th. Tramways and Omnibus Committee. 50 new tramcar bodies. Mr. A. Baker, general manager, Tramway Offices, Council House, Congreve Street.

January 10th. Electric Supply Department. Three 2,000-kW rotary-convertor equipments; two 1,000-kW ditto and two 750-kW ditto. (December 16th.)

Bolton.—The Corporation Tramways Committee has decided to invite tenders for the supply of 40 tramcar motors.

Chile.—SANTIAGO.—March 7th. Ports Commission. Five electric travelling portal cranes for Punta Arenas. (A.X. 5648.)*

Darfield.—January 17th. Education Committee. Installation of electric light at Darfield New Infants' School. Particulars from the Education Department, the County Hall, Wakefield.

Fletton.—Fletton, Woodston and Stanground Ex-Service Men's Club, Ltd. Electrical installation for the club premises. Particulars from Messrs. A. W. & H. J. Wilson, architects, Cumbergate, Peterborough.

Glasgow.—January 14th. Corporation. Work in connection with the overhead charging feeder system at Govan Refuse Destructor Works. Specifications from the engineer and manager, Electricity Department, 75, Waterloo Street, Glasgow.

India.—January 13th. India Stores Department. Two water-tube boilers, stokers, and condensing plant; two 300-kW high-speed vertical steam generator sets and condensing plant; one h.p. cubicle switchboard and one l.p. a.c. ditto; two 200-kVA transformers. Forms of tender from India Stores Department, Belvedere Road, S.E.1.

Liverpool.—January 26th. Electric Supply Department. Twelve months' supply of materials, including cables, meters, lamps, troughing, insulators, &c. (See this issue.)

Leicester.—January 21st. Electricity Department. Buildings, coal- and ash-handling plant, railway sidings, &c., three water-tube boilers complete, one 25,000-kW and one 1,500-kW turbo-alternators with condensing plant and accessories, and three ferro-concrete cooling towers. (December 2nd.)

London.—ISLINGTON.—January 20th. Electricity Department. 12 months' supply of cables, meters, transformers, lamps, wires, &c. (December 16th.)

H.M. OFFICE OF WORKS.—January 12th. Crude oil engine-generator set, booster set and panels for the Weeting Hall, Brandon, Norfolk. Contract Branch, King Charles Street, S.W.1.

CAMBERWELL.—January 16th. Borough Council. Twelve months' supply of electric lamps and maintenance of electric lighting, heating and power installations, telephones, &c. Forms of tender from Mr. W. Bell, borough engineer and surveyor, Town Hall, Camberwell, S.E.

Lourenco Marques.—February 13th. Ports and Railways. Two 350-h.p. electric motors. (B.X. 3996.)*

New Zealand.—WELLINGTON.—Public Works Department. February 18th. Storage battery and motor for Arapuni. (B.X. 4032.)*

April 21st. New Zealand Government Railways. Machine tools and workshop equipment. (A.X. 5647.)*

April 17th. Post and Telegraph Department. Sub-station protectors. (B.X. 4074.)*

TE AROHA.—January 17th. Thames Valley Electric Power Board. Thirty 11,000/415-V transformers. (B.X. 4075.)*

CHRISTCHURCH.—March 13th. Drainage Board. Nine electric centrifugal sewage pumping plants. (A.X. 5457.)*

South Africa.—WORCESTER, C.P.—February 1st. Municipal Council. Power station plant, consisting of water-tube boiler, automatic stoker, chimney and induced draught plant, steam piping, &c. (A.X. 5675.)*

Southall.—January 24th. Southall-Norwood U.D.C. Electric wiring installation at the Sanatorium, Mount Pleasant. (See this issue.)

Swindon.—January 14th. Electricity Department. 6,600-V and 3,300-V a.c. and 440-V d.c. switchgear. (December 16th.)

Uruguay.—MONTEVIDEO.—State Electricity Works. February 1st. 153,000 metres of galvanised flexible steel cable for guard wire. (A.X. 5654.)*

February 2nd. Installation of a telephone system between various localities. (B.X. 4082.)*

February 5th. Ministry of Public Works. 22 cranes for the Hydrographic Department. (A.X. 5478.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Eastbourne.—Electricity Committee. Accepted :—
Cable : Renewal of contract for the year on rise and fall basis.—Craigpark Electric Cable Co., Ltd.
Switchgear and transformers (£5,200).—General Electric Co., Ltd.

Glenafton (Ayrshire). — Sanatorium Committee. Accepted :—
Electrical work at the Sanatorium (£1,222).—Cowan and Linton.

Hull.—The Telephones Committee last week accepted a tender for British-made bronze wire at £283, in preference to a lower tender for foreign-made wire.

Ilford.—Electricity Committee. Accepted :—
1,000-kW rotary convertor (£2,985).—Crompton-Parkinson, Ltd.
Recommended :—
Kiosk and transformer for Grove Road Estate (£268).—Foster Engineering Co., Ltd.
Tramways Committee. Recommended :—
Tramcar washing plant (£154).—Equipment and Engineering Co., Ltd.

Lamp Contracts.—The Port of London Authority has placed three months' contracts for electric lamps with Siemens Electric Lamps & Supplies, Ltd., and Metro-Vick Supplies, Ltd.; Siemens Electric Lamps & Supplies, Ltd., has received a 12 months' contract for electric lamps from the Booth Steamship Co.; the Department of Posts and Telegraphs, Dublin, has placed a 12-months' contract for gasfilled and vacuum electric lamps with Siemens Electric Lamps & Supplies, Dublin Branch.

London.—CHELSEA.—Board of Guardians. Accepted :—
Installation of internal telephones at St. Luke's Hospital (£441).—Relay Automatic Telephone Co., Ltd.

Manchester.—Electricity Committee. Accepted :—
Electric tower wagon.—General Vehicle Co., Ltd.
"Zed" fuse fittings.—Santon, Ltd., Newport (Mon.) and W. E. Beardsall & Co., Ltd.
Cable, for six months.—Standard Telephones & Cables, Ltd.
Electric kettles, for six months.—Premier Electric Heaters, Ltd.
High pressure steam and feed water pipework.—Aiton and Co., Ltd.
Steam receiver for 40,000-kW turbo-alternator.—Babcock and Wilcox, Ltd.
High pressure steam valves.—Hopkinsons, Ltd.
High pressure feed water valves.—J. Blakeborough and Sons, Ltd.
Housing Committee. Accepted :—
Electric light installations on various housing estates.—Winter Bros., J. V. Pratt, S. Dickinson, —. Hanchett, Barratt & Currie, all of Manchester, and Hall & Stinson, Ltd., of Sheffield.
Education Committee. Accepted :—
Electric lighting installation at Blackley school.—Power Contracts, Ltd.; at Soss Moss school.—John Adams, Ltd.
Tramways Committee. Accepted :—
Battery charging set for Parr's Wood 'bus garage.—Lancashire Dynamo & Motor Co., Ltd.
Hydraulic armature press for car depôt.—Hollings and Guest, Ltd.
Cast-iron bases for tramway poles.—Hindsford Foundry Co., Ltd.

Sheffield.—Electric Supply Committee. Accepted :—
Additional transformers (£8,012).—British Electric Transformer Co., Ltd.
One 3-unit switch fuse board (£570).—A. Reyrolle & Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended :—
Switchgear (£3,798).—A. Reyrolle & Co., Ltd.

Stirling.—Accepted :—
Electric lighting and power installation at Stirling Combination Poorhouse (£650).—Lockhart & Macnab.

York.—Electricity Committee. Recommended :—
Switchgear in connection with supply to Rowntree's works (£793).—Metropolitan-Vickers Electrical Co., Ltd.

Forthcoming Events.

Royal Institution of Great Britain.—Saturday, January 7th, and Tuesday, January 10th. 21, Albemarle Street, W. 3 p.m. "Engines." Prof. E. N. da C. Andrade.

Institution of Electrical Engineers.—Monday, January 9th. Institution, London, W.C. 7 p.m. Informal meeting. "Portable Power Appliances." Mr. A. E. Loe.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 9th. University, Liverpool. 7 p.m. "Technical Principles of Broadcasting." Captain P. P. Eckersley.

(North-Eastern Centre).—Monday, January 9th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Ordinary meeting.

(North-Eastern Students' Section).—Friday, January 6th. Lighting Service Bureau, Northumberland Street, Newcastle-on-Tyne. 7.15 p.m. "Protective Gear." Mr. H. C. Atkins.

(Western Centre).—Monday, January 9th. Royal Hotel, Cardiff. 6.30 p.m. Reception and annual dinner.

(North-Midland Centre).—Tuesday, January 10th. Hotel Metropole, Leeds. 7.15 p.m. "The Problems of Public Lighting by Electricity." Mr. H. T. Harrison.

(North-Western Centre).—Tuesday, January 10th. Engineers' Club, Manchester. 7 p.m. Ordinary meeting.

(Scottish Centre).—Tuesday, January 10th. North British Station Hotel, Edinburgh. 7 p.m. "Storage Batteries in Relation to Modern Supply of Electric Lighting and Power." Mr. E. C. McKinnon.

(Scottish Students' Section).—Wednesday, January 11th. Royal Technical College, Glasgow. 7.30 p.m. "The Electric Drive for Ship Propulsion." Mr. T. Donaldson.

(South-Midland Students' Section).—Tuesday, January 10th. University, Birmingham. 7 p.m. "The Mercury Arc Rectifier Bulb." Mr. F. C. Orchard.

(Tees-side Sub-Centre).—Wednesday, January 11th. Cleveland Technical Institute, Middlesbrough. 7 p.m. "Electricity in the Home." Mr. J. H. Parker.

(Dundee Sub-Centre).—Thursday, January 12th. University College, Dundee. 7.30 p.m. Ordinary meeting.

Nottingham Society of Engineers.—Monday, January 9th. Victoria Station Hotel. 7.30 p.m. "Leicester Workshop Practice." Mr. B. P. Cooper.

Institution of Civil Engineers.—Tuesday, January 10th. Institution, Great George Street, S.W. 6 p.m. "Standards of Thermal Efficiency for Internal Combustion Motors." Sir Dugald Clerk, F.R.S.
Wednesday, January 11th. 6 p.m. "The Effect of Acceleration and Deceleration on the Wear of the Railway Track." Mr. R. T. Smith.

Physical Society and Optical Society.—January 10th, 11th, and 12th. The Imperial College of Science and Technology, South Kensington. Annual exhibition of electrical, optical, and physical apparatus.

Society of Technical Engineers (London Branch).—Wednesday, January 11th. 102, Belgrave Road, S.W. 7.45 p.m. "Industrial Prosperity in the United States : Report on a Visit of Investigation." Mr. P. A. Molteno.

Royal Society of Arts.—Wednesday, January 11th. John Street, Adelphi, W.C. 3 p.m. Dr. Mann Juvenile Lecture : "Flame." Prof. A. Smithells, F.R.S.

Overhead Lines Association.—Wednesday, January 11th. Institution of Electrical Engineers. 5.30 p.m. "Legislation, Regulations, and Policy for Rural Distribution of Electricity in France." Major T. Rich.

Institute of Fuel.—Wednesday, January 11th. Burlington House, W 6 p.m. "Utilisation of Town's Refuse and Refuse Fuels." Mr. A. Scorer.

Electrical Trades Benevolent Institution (North-East Coast Section).—Thursday, January 12th. Mr. Robson's Offices, Haymarket, Newcastle-on-Tyne. 2.30 p.m. Annual meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 13th. Mining Institute, Newcastle-on-Tyne. 6 p.m. "Diesel Engine Drive for Generators and other Auxiliary Machinery on Board Ship." Mr. J. Calderwood.

London Station Engineers, No. 1 Branch (E.T.U.).—Friday, January 13th. London and Brighton Hotel, Queen's Road, Peckham, S.E. 7.30 p.m. Annual concert.

Association of Mining Electrical Engineers (Western District Sub-Branch).—Saturday, January 14th. 62, Wind Street, Swansea. "Signalling in Mines." Mr. T. J. Reece.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

LUCIFER electric lighting sets.

Notes.

The Midland Electrical Engineers' Ball.

We are pleased to learn from the hon. secretary, Mr. W. Y. Anderson, that as the result of the Midland Electrical Engineers' Ball held at the Grand Hotel, Birmingham, on November 18th, the committee has handed a contribution of 75 guineas to the Institution of Electrical Engineers' Benevolent Fund.

The Overhead Lines Association.

The following meetings have been arranged, and will be held at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2, on Wednesdays, at 5.30 p.m.:—

January 11.—"Legislation, Regulations, and Policy for Rural Distribution of Electricity in France," by Major Theodore Rich, O.B.E., A.M.I.E.E., who has recently paid a visit to France.

February 8th.—"Joint Use of Wood Poles for Electricity Distribution and for Communication Systems," by Mr. E. S. Byng, M.I.E.E.

March 14th.—"Standard Overhead Lines: their Advantages and the Number of Different Standards Required," by Mr. D. C. Redfern.

Standard Corrosion Tests.

Dr. G. D. Bengough, M.A., formerly investigator to the Corrosion Research Committee of the Institute of Metals, is to lecture on "Corrosion, with Special Reference to Standard Tests" at a meeting of the London local section of the Institute (in the rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W.1) on January 12th, at 7.30 p.m. A similar lecture recently in Birmingham by Dr. Bengough was helpful and suggestive. Visitors are invited to the meeting on January 12th, for which tickets can be obtained from Mr. W. T. Griffiths, The Mond Nickel Co., Ltd., Victoria Station House, Westminster, S.W.1.

Appointments Vacant.

Plumber-cable jointer, for the Eccles Corporation Electricity Department. Plumber-jointer, for the Walton-on-Thames U.D.C. Electricity Department. (See our advertisement pages to-day.)

London Electricity Supply.

Arrangements have been made, as from January 1st, 1928, for the Deptford East and the Bow power stations of the London Electric Supply Corporation, Ltd., and the Charing Cross Electricity Supply Co., Ltd., respectively, to be transferred to the London Power Company, Ltd. This transaction completes the arrangements contemplated under the London Electricity (No. 2) Act of 1925 for the co-ordination and control of the several power stations belonging to the group of ten companies associated with the London Power Company.

Of these stations, that at Horseferry Road has been closed down, and arrangements are being made to take a similar step as regards Alpha Place, Wood Lane and Richmond Road. Considerable progress has been made during the past year with the extensions to and interconnection of the remaining stations.

It is expected that the first section of the new Deptford West Station will be available for commercial service early in 1929.

Very careful consideration is being given to the design of the new station at Battersea, which was sanctioned by the Electricity Commissioners last autumn.

High Voltage and Intense Magnetic Fields.

The anniversary meeting of the Royal Society was held in London last month, when Sir Ernest Rutherford, in his presidential address, referred to the results of investigations which have been carried out in recent years. According to *The Times*, he was informed that the General Electric Company, U.S.A., had a working plant giving a maximum of 2,800,000 volts, and hoped soon to have one to give six million volts. While no doubt the development of such high voltages served a useful technical purpose, from the purely scientific point of view, interest was mainly centred on the application of those high potentials to vacuum tubes in order to obtain a copious supply of high-speed electrons and high-speed atoms. A vigorous attack on that side of the question had been recently undertaken by Dr. Coolidge, who had constructed an electron tube which would stand 300,000 volts, the rays passing into the air through a plate of chrome-nickel-iron alloy about 0.0005 in. thick. It had not so far been found practicable to apply much more than 300,000 volts to a single tube, on account of the danger of a flash over. For the application of still higher voltages a number of tubes were arranged in series and communicating with one another, the fall of potential in each being about 300,000 volts. So far experiments had been made with three tubes in series and 900,000 volts, which gave a supply of electrons corresponding to one or two milliamperes through the thin window in the last tube. That gave an intense beam of high-velocity electrons, which spread out into a hemisphere extending to a distance of about two metres from the window. Marked luminous effects were produced in the air itself and in phosphorescent bodies placed in the path of the rays.

Electromagnets were ordinarily employed for the production of intense magnetic fields, but in order to provide fields of the order of half a million gauss, the use of the electromagnet must be abandoned. Dr. Kapitza suggested that intense momentary fields could be obtained by sending a very strong current through a coil for such a short interval that the heating of the coil was restricted to a permissible value. By special attention to the design, a coil had been constructed which gave a field of 320,000 gauss over a volume of about 3 c.c. without any signs of fracture. Measurements had been regularly carried out in fields of that magnitude. It was anticipated that the present design of coil would give about 500,000 gauss before it burst, and that still higher fields could be obtained in coils specially constructed for the purpose. The investigations, which had been carried out in the Cavendish Laboratory, Cambridge, had been made possible by the generous support of the Department of Scientific and Industrial Research.

Illumination by Fluorescence.

In connection with the Associated Edison Illuminating Companies' Convention at Colorado Springs, a spectacular method of illumination was shown. The sunken garden of the Broadmoor Hotel was flooded with invisible ultra-violet rays from quartz-tube mercury-vapour lamps fitted with powerful reflectors. The light was filtered through special lenses made of Corning glass, which obstructs all the visible light; it also prevents the band of short-wave energy deleterious to the eyesight from passing through. As silvered glass reflectors absorb ultra-violet rays, it was found necessary to make the reflectors of polished aluminium. The flowers, shrubbery, and evergreens were sprayed with chemicals which fluoresced under the ultra-violet rays. The chemicals used were zinc sulphide, eosin, and rhodamine. Each individual leaf, twig, or flower glowed in various colours. The water in the fountain in the centre of the garden was also treated with fluorescent chemicals, so that it became brilliantly luminous when the rays fell on it.—*Nature*.

Gas versus Electricity.

In his address at an auxiliary meeting of the North of England Gas Managers' Association, reported in the *Gas World*, the chairman, Mr. C. F. Barrow, distribution superintendent of the Sunderland Gas Co., dwelt on the subject, "Gas *versus* Electricity." Gas, he said, was already supplying cheap and reliable light, power and heat for the industries of this country, and therefore there was no need for the Government to finance the electricity scheme. He gave some particulars of what was being done in Sunderland to meet the keen electrical competition. It was decided to offer the slot-meter consumers of the gas company a good British inverted burner at a reasonable price, and allow them to pay for it out of the rebate when the meters were emptied. The slot-collecting staff was increased in preference to engaging a special staff of salesmen to dispose of the burners. As the collector had the right of entry into the premises, it was thought it would be easier to induce a sale in this way. The scheme was an immediate success; during the busiest period 3,000 burners were sold per week, and a total of over 30,000 had been sold. By a well-organised scheme of maintenance, the consumers were kept satisfied. It was also found that the maintenance men discovered many opportunities of advising consumers and booking orders. Mr. Barrow, concluding, said that the gas industry should not be lulled into inactivity by talk of friendly competition and the assertion that there was room for both gas and electricity. "Let us devote all our skill, energy and enthusiasm to furthering the interests of the undertaking we have the honour to serve."

Loud-speaker Fire Alarm.

A new type of fire alarm, known as the "Carter Micro," has been installed by the Edinburgh Fire Brigade at six outside centres as an experiment. The alarm is contained in a box erected at a street corner, and is connected with telephone instruments at the central fire station, says *The Times*. Anyone wishing to report a fire must break a small pane of glass in the box; that causes a door to open automatically, exposing to view two apertures. Above one are printed the words, "Wait; fireman will speak," and above the other, "Reply here." With the smashing of the glass there is given simultaneously an alarm ring at the fire station, and the fireman on duty replies through the ordinary telephone transmitter, his voice being amplified in the street box, and can be heard 12 ft. away. The person reporting the fire then gives the necessary information through the other aperture.

The I.E.E. Scottish Centre Benevolent Cup.

At a meeting of the Scottish Centre of the Institution of Electrical Engineers at Glasgow, on Tuesday, December 13th, a handsome cup, to be called the Scottish Centre Benevolent Cup, was presented to the members for the purpose of initiating a series of golf competitions, the proceeds of which are to be allocated to the Benevolent Fund of the Institution. As was explained in our issue of September 16th, the cup is the joint gift of Mr. Wilfrid L. Winning, M.I.E.E., immediate past-chairman of the Centre, and Mr. Andrew Hutcheson, A.M.I.E.E., ex-member of committee.

The cup, supplied by Messrs. Lindsay & Paisley, Ltd., Glasgow, is of solid silver, and is 18 inches high; as the accompanying illustration shows, it is of early Victorian design, with fluted base. On the top is a finely modelled figure of a golfer in the act of putting.

The Scottish Centre Benevolent Cup.

In handing over the cup on behalf of Mr. Hutcheson and himself, Mr. Winning gave some particulars of the financial position of the Benevolent Fund, and said he felt that the introduction of the love of sport into the Institution would help considerably in the augmentation of the Benevolent Fund. He hoped that the present chairman would be able to send to London a good sum for that purpose.

Mr. D. Macfarlane Macleod, chairman of the Centre, in accepting the cup on behalf of the members, said it was characteristic of the immediate past chairman and his colleague, Mr. Hutcheson, to think of those members who were passing through the shadows. These times of industrial depression had been the means of making many capable men experience great privation. It was a great revelation to him, on the first occasion when he met the Benevolent Fund Committee in London, to hear of the distressing cases which came before that Committee for consideration, and to learn of the totally inadequate funds which were at the disposal of the Institution for giving that relief which they felt had to be given; but their benevolence was limited by the means at their disposal. He appealed with confidence to the members to give the competition—particulars of which would shortly be announced—their wholehearted support, which was all they could do to show their gratitude to the generous donors of the trophy.

Institution of Mining Engineers.

The annual general meeting of the Institution of Mining Engineers will be held, by kind permission, at the rooms of the Geological Society, Burlington House, Piccadilly, W.1, on January 10th. Included in the papers to be submitted for discussion is one on "The Use of a Lamp-room Photometer," by Drs. J. S. Haldane and R. V. Wheeler. It is encouraging to see in the annual report of the Council that it is believed that the process of recovery of the coal industry has commenced, and that by determined effort and co-operation on the part of all engaged in the industry it may ultimately be restored to prosperity, although the progress may be painfully slow. The members on the roll of the Institution at July 31st, 1927, numbered 2,993, as compared with 3,140 for the previous year. The statement of accounts shows an income for the year of £5,921, as compared with £6,013 for the previous year.

The "Televox."

Developed by Mr. R. J. Wensley, switchboard engineer of the Westinghouse Electric and Manufacturing Company, the "Televox" is intended to supplement, but not supplant, supervisory control systems. It is most desirable that the system operator be given some means by which he can issue instructions to the apparatus in unattended stations and receive replies that his instructions have been obeyed. When the expense is warranted, there is no better method of doing so than by the use of one of the available types of supervisory control, which require individual control circuits of from two to four wires; they may be specially installed for the purpose, or be leased from the telephone company; in either case considerable expense is involved. The "Televox" is a machine endowed with enough apparent intelligence to carry on a conversation over a standard telephone through exchanges and their connecting cables in exactly the same manner as would a human operator, were such available; the device does not transgress the rules laid down by the telephone companies regarding attachments to their lines or instruments, for it actually "listens" to the receiver and "speaks" into the transmitter. Standard telephone systems operate at all frequencies between 300 and 2,800 cycles with reasonably small attenuation: the operating tones (or "voice") of the "Televox" are within these limits, tones corresponding to 600, 900 and 1,400 cycles having been chosen; the upper frequency is between the second harmonics of the two lower frequencies, which is necessary to prevent possible false operation due to the harmonic operation of the amplifier for the higher frequency, should this be a multiple of one of the lower frequencies. The dispatcher's equipment consists of three tuning-fork oscillators, a two-stage audio amplifier, a loud-speaker unit, and three push buttons; a standard telephone is placed on the desk in front of the loud-speaker unit. At the sub-station there is a two-stage amplifier, three "ladder-type" filters, and three individual-frequency amplifiers; relays in the plate circuits of the output valves in the final amplifiers operate the selective portion of the equipment (a set of telephone relays and selector switches). On the side of the box is a shelf on which a standard telephone is placed; the receiver is left off the hook, and is placed on a microphone, which forms the electrical "ear," a weighted arm projecting from the side of the box to depress the hook switch on the 'phone, which is arranged to be lifted by a magnet inside the cabinet. The telephone may be lifted from the shelf and used in the ordinary manner without the necessity for detaching, or disconnecting, any device; when the call is finished, the instrument is replaced on the shelf in immediate readiness for automatic operation. The three frequencies are used as three monotone syllables, and all the various commands are translated into a language composed of them. An ordinary ringing signal relay of the type used for operating special loud gongs or signal devices is installed by the telephone company, and furnishes the initiating means for the rest of the sub-station equipment; the relay makes contact when the bell rings, thus energising the magnet which lifts the weight from the hook switch and completes the circuit to the amplifying valve filaments. After an interval of about thirty seconds, during which the sub-station buzzer sends out the station code at intervals, the actuating circuits are opened by a timing device. For portable use the device can be operated by three carefully tuned pitch pipes of the proper tones, which enables the line repair man to operate the sub-station breakers from any telephone in private houses, or pay stations near the case of trouble; testing defective circuits is thus greatly expedited. Means are available for reading meters, ascertaining the height of water in reservoirs, reading the temperature of transformers, or other devices; in fact, doing almost anything that needs to be done in the controlling of a distant sub-station.

Agricultural Machinery Exhibition.

The French Exhibition of Agricultural Machinery will be held at Paris from January 21st to 29th, and a report will, as usual, appear in our pages.

A Turbo-electric Liner.

According to published reports, Lord Inchcape, in his address to the shareholders of the P. & O. Line, remarked that his superintendent engineer assured him that the company's new 17,000-s.h.p. turbo-electric liner would have a greater efficiency than a Diesel-driven ship.

A New Colliery-Cage Signalling System.

Attempts have been made to solve the problem of signalling between a moving colliery cage and the winding-engine room in a variety of ways. Now the Société des Ateliers de Constructions Electriques, of Charleroi, Belgium, has brought out a new signalling system known as the "Canivet," for which various advantages are claimed: particularly that it provides much greater security when the cage is engaged in conveying miners up and down the shaft, that it enables a higher cage speed to be maintained owing to the reliable working of the signalling arrangement, that it enables inspection of the shaft and the effecting of repairs thereto to be speeded up, and, above all, that it enables instructions to be orally given from the cage, when in motion, to the winding engine operator. A three-valve amplifier, similar to that used in wireless reception, which is supplied with current from a small battery of accumulators, is located in a cupboard in the winding engine room, in which a loud-speaker is the only other component of the installation. Hung on one of the walls of each cage is a small water- and dust-tight portable transmitter which, although it occupies but a small space, can, if necessary, be quickly removed temporarily for cage-unloading purposes. Each transmitter embodies a set of dry batteries, a compact insulated frame aerial, two interruptors (or vibrators), and a microphone. An insulated steel wire extends from the top to the bottom of the shaft, being "earthed" at its lower

end. Although in most cases a single wire is all that is necessary, in order to prevent interference with telephone communication by parasitic currents, the makers recommend the use of a separate earthing wire. The two wires are spaced some little distance from each other, but as near the cage as possible. During the raising or lowering of the cage, if it is desired to signal to the engine man, all that is necessary is for a man to press a button on the transmitter, which completes the circuit between the vibrator and the aerial, and an induced current flows in the steel wire. In the engine room at the surface this current is amplified, the engine man being given a sufficiently audible warning by means of the loud-speaker, notwithstanding the noise made by the machinery. When the miner in the cage releases his pressure on the button of the transmitter, the circuit is broken; thus by means of the button the ordinary system of signalling in mines can be effectively adopted in the new arrangement, which has been in successful operation for some time at the Boubier collieries at Chatelet, Belgium. A second button on the transmitter enables the microphone circuit to be closed so that instructions given orally before the microphone are reproduced by the loud-speaker at the surface, and, as verbal messages are usually given when the cage is at a standstill, they are perfectly audible. As the "Canivet" signalling arrangement is operated merely by the pressing of one or two buttons, it is claimed that its working is so simple that even the least intelligent miner can quickly operate it.

California's Steam Wells.

Steam wells, where the earth is tapped for natural heat as it is elsewhere for natural gas or oil, promise to deliver power in paying quantities. The first development of this kind in America, at "The Geysers" in California, has been given a thorough scientific examination by Dr. E. T. Allen and Dr. A. L. Day, of the Carnegie Institution of Washington, and their report has recently been made public.

The steam well region is in a little valley in the Coast Range, near San Francisco. There seems to be abundant steam at high temperatures and pressures when the borings are sunk. Eight wells have been bored so far, to depths of between 200 and 650 feet. These develop steam pressures between 60 and 275 pounds per square inch. Quantitative measurements of the output of four of the wells indicate a total power equivalent to 4,500 kilowatts. In spite of the borings, no diminution of steam flow at the natural fumaroles in the valley has been noted. Neither do the wells seem to diminish each other's activity, although two of them are within 50 feet of each other.

A similar enterprise on a larger scale is in existence at Larderello, Italy, where the commercial production of power has already been realised. The California development has one advantage over the Italian wells, in that the Larderello steam contains corrosive acids, which necessitates more or less elaborate purifying processes before it can be used, whereas the California wells yield a steam whose acidity is so low that it can be used in its natural state.—*Science Service.*

Lightning at Sea.

Lightning struck the British Royal Mail liner *Araguaya* (10,196 tons) during the night of December 26th as she was steaming from Bermuda to New York. As though a knife had been used, the aerial attached to her foremast was cut clean away. Third Officer T. Davies, who was on the bridge, was burned on the right hand and was blinded for a few minutes. Wireless Operator Hinkley, who was wearing a headpiece, was dazed by an explosion. The lightning passed down both sides of the ship, its blue flame illuminating the night. It changed the ship's magnetic compass and put all compasses from four to six points out of their true bearing. Capt. B. Shillitoe told the *Daily Mail* that the lightning would have gone down the steel rigging without doing any damage if it had not struck the aerial. He turned the *Araguaya* round, regained his bearings by a north wind blowing at a velocity of 20 miles an hour, and then corrected the errors of the standard compass by observations of the Pole-star. Excellent wireless bearings received later off the American coast finally gave him his true direction.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

New Year Honours.—Though electrical affairs have loomed largely on the horizon of statesmen during the last year or two, there is no liberal outpouring of honours for electrical men in the New Year's List. We have, however, the pleasure of tendering our congratulations to Mr. JOHN REEVE BROOKE, C.B., Secretary to the Central Electricity Board, upon being made a knight, and to Mr. THOMAS ERNEST STANTON, C.B.E., F.R.S., D.Sc., Superintendent of the Engineering Department at the National Physical Laboratory, upon whom is also conferred the distinction of knighthood. Mr. WILLIAM THOMAS LEECH, Director of Telegraphs and Telephones, becomes a C.B. (Civil Division).

The Lord Chancellor has appointed Lieut.-Colonel H. J. HIGGS, A.M., O.B.E., managing director of Messrs. Ransome and Marles, Ltd., Newark, to the Commission of the Peace for the Borough of Newark.

The vacancy on the staff of the Warrington Corporation Electricity Department caused by the death of Mr. E. Rathbone, assistant mains engineer, has been filled by the promotion of Mr. R. L. EDGAR, who has been succeeded as shift engineer by Mr. P. J. HOLGATE.

Mr. WILLIAM BENTLEY BARLOW, engineer-in-charge of the Helsby branch of the British Insulated Cables, Ltd., retired on December 31st, after 40 years' service with the firm. Mr. Barlow served his apprenticeship at Manchester and went to Helsby in 1887. He has been a member of the Helsby Parish Council since its formation and for twelve years was chairman.

Dr. THOMAS STOCKHAM BAKER, president of the Carnegie Institute of Technology, Pittsburgh, U.S.A., expects to spend six weeks in Europe during February, March, and April, to organise plans for the second International Conference on Bituminous Coal at Pittsburgh. The first conference was held in November, 1926, under the auspices of the Carnegie Institute of Technology, and was attended by 1,700 delegates and leading fuel scientists from thirteen different countries. The second conference, which will be held under the same auspices, is scheduled for the week commencing November 19th, 1928.

As we mentioned in our last issue, Mr. R. S. HILTON, the managing director and deputy-chairman of the Metropolitan-Vickers Electrical Co., Ltd., has accepted the position of sole managing director of the United Steel Companies, Ltd. The United Steel Companies is one of the largest industrial combines in this country. Mr. Hilton, who for many years held the dual position of secretary and general manager of the Birmingham Gas Department, joined the Metropolitan-Vickers Co.

Mr. R. S. Hilton.

in 1918. The very wide experience acquired in these positions in both commercial and manufacturing practice, and those welfare and social activities which are a distinguishing feature of the Metropolitan-Vickers Co., and which he personally did so much to encourage, should prove of the utmost value in his new position. Mr. Hilton is also vice-chairman of the Council of the British Electrical and Allied Manufacturers' Association.

Mr. GEORGE HUNTER, of the Newcastle-upon-Tyne Electric Supply Co., Ltd., Lighting and Heating Department, has been appointed showroom, sales and publicity superintendent in the Lincoln Corporation Electricity Department.

The *Financial Times* reports that the directors of Chadburn's (Ship) Telegraph Co., Ltd., state that Mr. W. R. CHADBURN ceased to be managing director in March last, and that he has no official capacity in the company. Mr. ALFRED CHADBURN BAMFORD is now the managing director.

The Blackpool General Purposes Committee recommends that the salary of the electrical engineer and tramway manager (Mr. C. FURNESS) be increased from £1,250 to £1,600 a year.

The Leicester Corporation Electricity Committee has appointed Mr. JOHN MOULD, now chief assistant, as acting engineer and manager, pending consideration of the vacancy caused by the retirement of Mr. T. R. Smith.

At the Hotel Metropole, Leeds, recently, a presentation was made to Mr. ARTHUR CLEGG, accountant of the Yorkshire Electric Power Co., on his attainment of 21 years' service with the company. A handsome canteen of cutlery was handed to Mr. Clegg on behalf of the staff by Mr. J. J. H. Stansfield (secretary of the company), who was supported by Major H. C. Fraser and others. Mrs. Clegg received a piece of plate and a beautiful bouquet.

The *South African Mining and Engineering Journal* states that the Council of the S.A. Institute of Electrical Engineers has awarded the Institute's gold medal for the best paper read during the year 1926 to Mr. T. P. PASK, M.I.E.E., chief electrical engineer, S.A.R., for his paper on the electrification of the Natal system.

Obituary.—HERR G. SCHMIDT.—The death recently occurred in Berlin, Germany, at the age of 61 years, of Herr Georg Schmidt, a director of the Siemens & Halske Co., with which concern he had been associated for about 40 years.

MR. G. C. JACK.—*The Times* records the death at the age of 70 years of Mr. George Cockburn Jack, who entered the warehouse of John Pender & Co., of Manchester, at the age of 15. His father came to London the following year at the suggestion of the late Sir John Pender, who was then endeavouring to make the submarine cable a commercial success. Fifty-one years ago Mr. G. C. Jack joined the accountants' department of the Eastern Telegraph Co., and for 40 years he was the accountant to the Eastern Extension Co.; he held that position at Electra House, London, E.C., at the time of his death.

MR. S. M. JONES.—Mr. Senter M. Jones, first vice-president, manager of purchases, and member of the executive committee of the Century Electric Company, St. Louis, died very suddenly on December 11th, at the age of 47 years. Mr. Jones entered the organisation in 1906. He was a member of the American Institute of Electrical Engineers, the St. Louis Electrical Board of Trade, and was interested in various other organisations as well as in the activities of the company's employés.

MR. T. B. THOMAS.—The death occurred, on January 1st, under tragic circumstances, of Mr. Thomas Baden Thomas, assistant mains engineer to the Aberdare Municipal Electricity Department. Mr. Thomas was married on December 22nd and developed pneumonia while on his honeymoon.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Erith Electrical Contractors, Ltd.—Private company. Registered December 28th. Capital, £100 in £1 shares. To carry on the business of contractors in the execution of work in connection with electricity, electrical installation, wireless and analogous uses in the electrical trade, &c. The subscribers (each with one share) are:—C. Parker, 7, Whitehill Road, Chingford, clerk; C. Payne, 96, Riverdale Road, Erith, company secretary; J. Corey, East Hill, Kemsing, Kent, financier. W. J. Barber signs as director. Registered office: 88, High Street, Erith, Kent.

B.I. Pension Trust, Ltd.—Private company. Registered December 31st. Nominal capital, £100 in £1 shares. Objects: To act as trustees of the existing pension fund for the benefit of the staff employés of British Insulated Cables, Ltd., and British Insulated Cables (S.A.), Ltd. The directors are to number five (two to be directors and nominees of British Insulated Cables, Ltd., and three to be staff employés). The first are:—D. Sinclair, "Oakwood," Weybridge, Surrey, and J. A. Smith, 5, Fazakerley Street, Liverpool (nominees of the company; and W. Korfoot, Prescot Hill, Prescot, D. Bates, The Orchard, Huyton, and B. Welbourn, The Croft, Rainhill (staff directors). Solicitors: Hill, Dickinson & Co., Liverpool.

Official Returns of Electrical Companies.

Johnson & Tanner, Ltd.—Mortgage on 2, Park Terrace, Worcester Park, Surrey (freehold), dated December 15th, 1927, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £800.

Pontypool Electric Light and Power Co., Ltd.—Satisfaction in full on December 8th, 1927, of mortgage or charge dated October 1st, 1898, securing debenture stock in respect of which £5,000 was outstanding on July 1st, 1908.

Whitehall Electric Investments, Ltd.—Capital, £7,500,000 in 5,000,000 ordinary and 2,500,000 preference shares of £1 each. Return dated June 30th, 1927. All shares taken up. £2,500,007 paid on 7 ordinary and 2,500 000 preference shares. £4,999,993 considered as paid on 4,999,993 ordinary shares. Mortgages and charges £3,352,248.

Birkdale and District Electric Supply Co., Ltd.—Capital, £50,000 in £5 shares. Return dated June 13th, 1927. 9,200 shares taken up. £46,000 paid. Mortgages and charges £25,000.

Bideford and District Electric Supply Co., Ltd.—Capital, £50,000 in 20,000 preference and 30,000 ordinary shares of £1 each. Return dated April 27th, 1927. 11,922 preference and 15,324 ordinary shares taken up. £27,246 paid. Mortgages and charges nil. Return of allotments, made up to August 31st, 1927, shows a further 200 preference and 212 ordinary shares allotted for cash, and fully called up.

Witton-James, Ltd.—Capital, £6,100 in 2,000 preference and 4,000 ordinary shares of £1 each and 2,000 deferred shares of 1s. each. Return dated July 25th, 1927. All shares taken up. £2,000 paid on 2,000 preference shares. £4,100 considered as paid on 4,000 ordinary and 2,000 deferred shares. Mortgages and charges, £25,000.

Portable Wireless, Ltd.—Debenture dated December 12th, 1927, to secure £100, charged on the company's property, present and future, including uncalled capital. Holder: J. Parsons, 61, Curzon Road, Muswell Hill, N.

Provincial Tramways Co., Ltd.—Capital, £275,440 in 10,000 preference shares of £10 each and 175,440 ordinary shares of £1 each. Return dated May 5th, 1927. 10,000 preference and 124,560 ordinary shares taken up. £162,700 paid on 3,814 preference and 124,560 ordinary shares. £61,860 considered as paid on 6,186 preference shares. Mortgages and charges, £80,140.

Miller's Radio Products, Ltd.—Debenture dated December 9th, 1927, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: P. H. Thorpe, 23, College Crescent, Hampstead, N.W.3.

City Notes.

Burndept Wireless, Ltd.

The annual meeting was held on December 30th. Mr. J. Macgregor (chairman) presided, and in the course of his speech mentioned that he joined the board in November, 1926, when Messrs. Johnson & Phillips, Ltd., lent the company £50,000 secured by a second debenture charge. It had been found that the prospects of the business were on a different level from that which existed at the time of the company's formation. Recovery could only be effected by drastic reductions in expenses. In June last, upon the application of the bank, a receiver and manager was appointed. The latter had adopted a very reduced basis for the valuation of the stock. The directors' conservative estimate was £61,500, whereas the receiver used the figure of £39,500; that accounted for £22,000 of the apparent loss of £68,859 during the six months ended June last. Again, in view of the appointment of a receiver to Radio Accessories, Ltd., the investment in that company had been written off. It had appeared in the books at the figure of 5s. per share and the writing-off of the item accounted for a further £15,000 of the apparent loss. The actual loss on trading for the six months was therefore about £31,570. Although the directors had succeeded in reducing the rate of loss, they could not make any real headway, as the economies effected were more than outweighed by the decline in turnover. The board agreed with the receiver that he should continue the business for at least three months, when a scheme of reorganisation would be presented to preserve some small interest for the present shareholders. Mr. J. B. Clark opposed the adoption of the report. He described the maintenance of a research department as a luxury, and said that the placing of a new receiving set on the market in six months' time would be too late for the season. He suggested that it would be wiser to close down at once. Mr. Hart considered that it would be better to carry on for three months as suggested. The report was eventually adopted, and it was decided that a committee of two shareholders with power to co-opt a third should be formed to act in conjunction with the board.

Edison Swan Electric Co., Ltd.

The annual meeting of the company was held on December 30th. Mr. C. F. Spencer (chairman), who presided, in presenting the report and accounts (*vide* our last issue, p. 1137) said that the increase of nearly £70,000 in investments was due to the taking up of shares in the Altrincham Electric Supply, Ltd. The balance sheet showed that the share and debenture capital had remained stationary but since July 1st the debenture debt had been reduced by the operation of the sinking fund. The increase of £68,750 in loans from bankers was due principally to the investment in the Altrincham Company. The reduction in the profit was largely owing to the effects of the coal dispute; coal had cost the company £5,000 more. During the first five months of the current year business had been in excess of that of the corresponding period of the preceding year. The results from Edison Swan Cables, Ltd., had exceeded their most sanguine expectations and the company was proving a valuable property. The report and accounts were adopted without discussion.

Newfoundland Power and Paper Co., Ltd.

Meetings of holders of "A" and "B" debenture stock were held last week, when the sale of the company's property to the International Power & Paper Co. of Newfoundland, Ltd., was approved. It was stated that negotiations with the International Paper Co., of New York, had led to the formation of the Newfoundland Co. with a capital of £5,000,000; of this £2,580,000 would be issued in connection with the purchase. The "A" stock, issued under the Trade Facilities Acts would be repaid in exact accordance with the terms of issue. The date of repayment of the "B" stock would be January 15th, 1970, at a premium of 5 per cent. instead of at par as at present.

Foundation Co., Ltd.

The annual meeting of the company was held on December 30th. Mr. J. G. B. Stone presided in the absence of the chairman, Mr. A. W. Tait, through ill-health. In presenting the report, which was reviewed in our last issue (p. 1137), the chairman said that while the previous year's progress had not been maintained the results were not unsatisfactory in view of the industrial position. In their main department, general engineering, development and expansion at home had been steady and satisfactory, and in Australia and India, where they were actively employed, prospects were promising. The directors had full confidence in the future of the company.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register and these companies are thereby dissolved:—

Bower Electric (Bristol), Ltd.
Electricity (Scunthorpe), Ltd.
Radio Ebonite Supplies, Ltd.
Radio Stocks, Ltd.
S.W. Radio, Ltd.
Wellington Electrical & Radio Engineering Works, Ltd.
Williams-Stokes Wireless Co., Ltd.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

Beaver Trust.—200,000 shares of £1 each, fully paid, Nos. 1 to 200,000.

St. Maurice Valley Corporation.—340,000 seven per cent. sinking fund cumulative preference shares of $5 each, fully paid, Nos. 500,001 to 840,000.

Associated Electric Co.

The company intends to retire a substantial amount of the $65,000,000 5½ per cent. convertible gold bonds and has offered the holders the option of exchanging them for $6 dividend series preferred stock of the Associated Gas & Electric Co. on favourable terms.

Still Engine Co., Ltd.

The accounts for the year ended March 31st last record a further loss of £14,995, making the total deficit £93,086. Schemes for maintaining the company's business are being considered by the board and will be placed shortly before holders of debentures and shares.

Dumbarton Burgh and County Tramways Co., Ltd.

The accounts for the year ended July 31st, 1927, show a deficiency of £6,883, after writing down certain property to the extent of £2,230. A balance of £4,747 is transferred from reserve reducing the loss to £2,136. The directors are arranging terms for dealing with the holders of debenture stock and ten-year notes.

Southern Canada Power Co.

The earnings of the company and its subsidiaries during the year ended September 30th last amounted to $627,742, as compared with $573,563 in 1925-26. Dividends on the preferred stock absorbed $294,392 and those on the common stock $180,000; $153,000 is transferred to depreciation reserve, leaving a balance of $166,715.

International Light and Power Co.

As the majority of the preference and ordinary shares (about 72 per cent.) are now in American hands, the office of the company has been removed from London to New York (120, Broadway).

Associated Telephone and Telegraph Co.

The usual dividend has been declared on the 7 per cent. preferred stock in respect of the quarter ended December 31st.

Stocks and Shares.

TUESDAY EVENING.

As was to be expected, business in the House during the current week has not been very active, the aftermath of Christmas, coupled with the usual New Year's Day holiday, being somewhat disturbing factors. Members re-assembled on Wednesday morning, and after exchanging holiday-cum-blizzard experiences, settled down to get through the accumulation of week-end orders, with the result that Wednesday, taking all things into consideration, was a fairly busy day. After this business in all sections sagged off considerably, and matters were not helped by the breakdown of the telephone and telegraphic communications, a legacy of the previous week-end storm. In spite of these hindrances business has not been entirely devoid of interest, as witness the movements in Metropolitan Railway ordinary and Canadian Marconi common, to mention only two instances. A marked feature was the strength of British Government securities and all "money" stocks on the success of the new Treasury loan.

London Traffic.

The star performance in the Home Railway market was Metropolitan Railway ordinary stock, which became prominent on merger rumours in connection with the Underground Group and London North-Eastern Railway. There may be nothing in it, but the railway's rather peculiar position under the proposed London Traffic Pooling Scheme would be solved by such an amalgamation, and the market is inclined to give credence to the rumour in spite of semi-official denials. In consequence, active dealings took place, raising the price to as high as 77½ at one time, as against 68 a week ago. Only part of the rise was sustained, the present price being 73¼, still a considerable advance over the lowest price of the year—52½. Districts moved in sympathy, gaining two points. Undergrounds were also in considerable demand, the ordinary touching 21s., the income gaining three points at 10s. A dividend of between 5 per cent. and 6 per cent. is anticipated on the ordinary, which is regarded as a promising lock up at present prices. The Group Companies have presented a somewhat uneven appearance with a slight sagging tendency in some of the junior stocks.

Electricity Supply.

Dealers in English electricity supply shares are expecting considerable activity during the next few months. Practically all these companies' financial year ends with the calendar year, with the reports making their appearances round about March and April. Results, it is anticipated, will in nearly all cases show considerable improvements over the figures for 1926, which were adversely affected by the coal and general strike and resultant heavy increases in the price of coal. Added to this it is known that a considerable amount of new money will be required. From the investors' point of view this is badly wanted, as it is becoming increasingly difficult to obtain anything but a small supply of the debentures and preference shares of this group. The only stock obtainable in any amount, at the moment, is County of London 5 per cent. debenture at a shade over par, free of stamp. As the company cannot repay until 1965, this stock is in demand as a long-term safe investment. There has been a little buying of some of the ordinary shares, such as Midland Counties, Newcastles, Scottish and Metropolitan Supply which has created a hardening tendency, but otherwise business has been on a small scale. Oxford Electric Company are about to create a further 100,000 £1 ordinary, to be offered to existing ordinary shareholders at 25s.

Foreign and Colonial Electrics.

The Atlas Company again provided one of the most active in the foreign lighting companies, a considerable number of shares changing hands. Ordinaries are 18s., preference 21s. 3d., and the 6 per cent. debenture, in short supply, at 10s. Mexican Lights were a good market, gaining 7 points at 68, with the preference five points to the good at 79. Perak River Hydro-Electric ordinary gained the turn at 15s. bid, with the 7 per cent. participating debenture stock unchanged at 106½. Whitehall Electric Investments preference were harder. The New East African Power 7 per cent. preference were 6d. premium bid with the ordinary 24s. bid. Calcutta and Madras ordinary were in small inquiry. Either an issue on bonus terms or a distribution of capitalised reserve is expected in the case of Madras during the current year. Kalgoorlie Light 10s. ordinary were a shade lower at 7s. 6d. The South American Light and Power Company are repaying their outstanding 5 per cent.

debentures at 102 on June 30th next, and for the benefit of stockholders who require their money earlier will redeem at 100 plus accrued interest at any time earlier.

Wireless and Cables.

Marconis, after fluctuations, touched 42s. as a result of the recent meeting, and Marconi Marines are in demand and spurted to 31s. 6d. Canadian Marconi, supported from the other side, opened with a blaze of strength last Wednesday morning, reaching 16s., a rise of about 5s. on the day. Subsequent profit-taking dropped the price to 13s., to be followed by a subsequent revival to 15s. Earlier in the year these shares were under 5s. Cable shares were undecided, and, on the whole, uninteresting. Easterns are practically unchanged at 145, with Eastern Extensions and Western both dull spots at 15 and 14, respectively. Indo-Europeans were put down to 35, whereas Great Northern added 2½ points to their quotation. Although existing holders are now as a whole, "sitting tight," it is only to be expected that prospective investors will be inclined to fight shy of cable shares until it can be seen more clearly than at present what ultimate effect wireless competition is going to have on the cable concerns. This being the case, it is fairly clear that for some little time to come business will tend to be uncertain and probably on a small scale.

Tramways.

Most of the interest here was monopolised by the foreign section. Mexico Trams, in sympathy with all things Mexican, spurted to 34½, a rise of some 7 points. The first bonds at 79 are no less than 7 points to the good. Brazilian Traction common and preference moved within narrow limits, and ended the week unchanged. Barcelonas have improved to 68. British Columbia Electric Railway deferred shares at 17s. 10½d. are now up to the price of deferred stock. Colombo Tramways Company have this week repaid their outstanding 5 per cent. debenture stock at 105, a result of the sale of their electric undertaking. The securities of the Anglo-Argentine Trams Company failed to respond to the official announcement that the Municipality of Buenos Aires have declined the offer put forward by a London group to construct a new underground railway in that city. Apart from a rise of a point in London United Trams 4 per cent. debenture and small inquiry for Lancashire United Transports at 8s. 3d., Home tramways were featureless.

Manufacturing.

This section was not without its points of interest, although business was not on a large scale. General Electrics were inquired for, a result of a big contract received from the Underground Company for motors. Brush were slightly higher at 30s., as were English Electric at 9s. 6d., with the preference 9d. to the good at 12s. 6d. The report of Edison Swan resulted in a small inquiry for the 4s. ordinary at 10s., but as most of the shares are now held privately it is a most restricted market. Crompton-Parkinson 6 per cent. preferred are better at 16s. 6d. It is understood that the results to date of the recent amalgamation have exceeded expectations. The Westinghouse Brake report is due in a few weeks, and the market looks for a dividend of about 10 per cent., against 8 per cent. last year. The shares have been in considerable demand, and advanced sharply to 36s., leaving off slightly under the best. Consolidated Signals, whose sole asset is a parcel of some 390,000 Westinghouse Brake shares, moved in sympathy, and at one time touched 52s. British Aluminium ordinary have risen to 46s. 3d., and are still considered moderately valued. General reserve now equals 65 per cent. of the share capital, a result of conservative dividend distribution in the past. Babcock and Wilcox have been in small demand, and among low-priced shares Pease & Partners, Vickers and Armstrongs are all in better form. Metropolitan-Vickers were inquired for on hopes of a larger distribution for 1927 than the 8 per cent., which has been paid for the last few years. Holders of shares in the larger of the electrical manufacturing companies should not lose sight of the possibility of a large scale amalgamation in the not too distant future.

General.

There is little doubt, from the way markets have opened for the New Year, that once the present twenty-one day account is out of the way there will be considerable activity in most sections of the House. Trustee stocks are becoming more and more scarce, with the result that would-be investors are having to turn to first class railway, public utility, and industrial debentures, which are already, in many cases, in short supply. Business in the industrial market continues to increase with an almost unlimited demand for any share giving scope for capital appreciation. Such a mundane consideration as the yield on last year's rate of dividend appears to be entirely ignored in this section, with the not unnatural result that prices here and there have risen out of all proportion to actual merit, and would-be buyers seem contented to discount the future for a very long way ahead. The rubber market, somewhat curiously, failed to respond to the further reduction of stocks, and the Oil Section, apart from a small demand for Mex Eagles, was almost lifeless. Textiles and artificial silk shares were fairly active, and there was a more optimistic feeling in connection with shares of the "heavy" industries.

Share List of Electrical Companies.

	Nom.	Dividend. 1926.	Dividend. 1926.	Price Jan. 3 1928.	Rise or fall.	Yield p.c
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	14†	14†	60'6	—	4 12 10
Brompton Ordinary	£1	10	8½	24/6	—	5 14 8
Charing Cross Ordinary	£1	15	8½	26/-	—	5 7 8
do. do. 4½ Pref.	£1	4½	4½	17/6	—	5 9 10
Chelsea	£1	12	8½	25/6	—	5 9 10
City of London	£1	15	10	30/-	—	4 13 4
do. do. 6% Pref.	£1	6	6	23/-	+6d.	5 4 4
Clyde Valley	£1	8	8	29/-	—	5 0 0
County of London	£1	15	7½	28/6	—	4 18 8
do. do. 6% Pref.	£1	6	6	23/-xd	—	5 4 4
Edmundson's Ordinary	£1	8	10	45/-	—	4 8 11
do. 7% Pref.	£1	7	7	25/6	+1/-	5 9 10
Elec. Supply Corporation	£1	11	11	38/9	—	6 10 0
Kensington Ordinary	£1	15	8	25/6	—	5 9 4
Lancs. Light and Power	£1	7½	7½	27/-	—	5 11 1
London Electric	£1	10	8½	25/6	+6d.	5 9 10
do. do. 6% Pref.	£1	6	6	23	—	5 11 5
Metropolitan	£1	11	6	20/-	—	4 18 4
do. 4½% Pref.	£1	4½	4½	17/-xd	—	5 8 8
Midland Counties	£1	6	6	24/-	—	5 0 10
Newcastle-on-Tyne Ordinary	£1	7	6	23/9	—	4 4 8
do. 5% Pref.	£1	5	5	17/6	—	5 14 [illegible]
do. 7% Pref.	£1	7	7	25/-	—	5 12 [illegible]
Notting Hill 6% Pref.	£10	6	6	10½xd	—½	5 11 7
North Met. Elec. 6% Pref.	£1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	£1	17½	8	26/-	—	5 7 8
South London	£1	15	8½	25/6	—	5 9 10
South Metropolitan Pref.	£1	7	7	1½	—	5 8 0
Urban Ordinary	£1	7	7	1½	—	5 16 8
do. 6% Pref.	£1	6	6	1/-	—	5 18 [illegible]
Westminster Ordinary	£1	15	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	21/4½	+1½d.	7 0 4
Yorkshire Elec.	£1	8	8	32/-	—	5 0 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	5	73½	+3½	4 1 8
do. District	,,	9½	9½	68½	+2½	5 2 6
Underground Electric	£1	Nil	1½	21/-	+1/6	1 8 6
do. do. Income	Bonds	6	6	103	+3	5 11 1
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	93½	—	6 8 4
do. Def.	,,	1½	1½	24½	+½	6 3 9
Automatic Telephone	£1	8	10	46/3	—	4 6 6
Chili Telephone	£5	5	5	7¾	—	3 18 8
Eastern Extension	£10	10	10	15	—	*6 13 4
Eastern Tel. Ord.	Stock	10	10	145	—	*6 17 4
Globe Tel. and T. Ord.	£10	10	10	14½xd	—	*6 15 7
do. do. Pref.	£10	6	6	10½xd	—	5 4 6
Great Northern Tel.	£10	20	20	41	+2½	4 17 7
Indo-European	£5	8½	10	35	−5	*6 1 5
Marconi	10/-	Nil	5	41/3	+3/9	2 8 6
Marconi-Marine	£1	7½	8½	30/-	—	5 16 8
Oriental Telephone Ord.	£1	12	12	50/-	—	*4 16 0
United R. Plate Tel.	£5	8	8	9¾	—	*4 1 0
Western Telegraph	£10	10	10	14	—	*7 2 10
HOME AND FORRIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	82½xd	—	7 6 8
do. do. 2nd Pref.	£5	6	6	82½xd	—	8 0 0
do. do. 5% Deb.	Stock	5	5	76½	+1	6 12 5
British Electric Traction Def. Ord.	,,	—	—	600	—	... ...
do. do. 8% Pref. Ord.	,,	7	8	121½	+1	6 8 6
Brazil Traction	£100	6	6	224	—	2 13 6
Brit. Columbia Elec. Ry. Pcc.	Stock	5	5	93½	—	5 6 1
do. do. Preferred	,,	6½	6½	148½	—	*4 4 3
do. do. Deferred	,,	8	8	128	—	*4 5 1
do. do. Deb.	,,	4½	4½	83½	—	5 3 0
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	8/-	—	... ...
London United Tram. Deb.	Stock	4	4	55½xd	+1	7 4 2
Mexico Trams, 5% Bonds	—	5	5	70	+7	6 4 3
Mexican Light Common	£100	Nil	Nil	68	+7	... ...
do. Pref.	£100	Nil	Nil	70	+5	... ...
do. 1st Bonds	—	5	5	80½	+2	6 6 0
Yorkshire (West Riding)	£1	5	—	7/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	£1	12	12	3⅛	—	4 3 4
British Aluminium Ord.	£1	12½	10	46/8	+9d.	4 7 0
British Elec. Transformer Pref.	£1	7	7	18/8	—	7 13 6
British Insulated Ord.	£1	15	15	4⅛	—	3 14 0
Brush Ord.	£1	10	10	30/-	+1/3	6 13 4
Callenders	£1	15	15	8½	—	3 16 4
do. 6½% Pref.	£1	6½	6½	23/-xd	—	5 9 8
Crompton Parkinson Pref. Ord.	£1	—	—	15.6	+fd.	... ...
Edison-Swan	£/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	88xd	—	5 13 6
Electric Construction	£1	10	7½	25/-	−1/3	6 0 0
Enfield Cable Pref.	£1	7½	7½	28 9xd	—	6 6 0
English Electric	£1	Nil	Nil	9/6	+9d.	... ...
do. do. Pref.	£1	6	8	12/6	+9d.	... ...
Gen. Elec. Pref.	£1	6½	6½	24/-	—	5 8 4
do. Ord.	£1	7½	7½	33/6	—	4 7 0
Henley	£1	20	25	102/6	—	4 17 8
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	2	Nil	18/9	—	... ...
Johnson & Phillips	£1	17½	12½	51/9	—	4 15 10
Met.-Vickers Ord.	£1	8	8	30/-	—	5 6 8
do. Pref.	£1	8	8	2½	—	6 4 8
Siemens Ord.	£1	7	7½	30/-	—	5 0 0
Telegraph Construction	£2	10	10	24½	—	*5 0 0

* Dividends paid free of Income Tax.
† 4% of which was Tax Free.

Conditions in Argentina.

Some useful Trading Advice by the British Commercial Secretary at Buenos Aires.

THE Department of Overseas Trade has received from Mr. H. O. Chalkley, C.B.E., Commercial Secretary at Buenos Aires, a report, dated September, 1927, upon the commercial, economic, and financial conditions in the Argentine Republic. (Stationery Office, price 2s. 6d. net.)

The introduction to the report is a study of British trade relations with Argentina, and it is pointed out that there is a pressing need for an increase in British exports to the Republic. The time has passed when industrial advantages alone could be counted on to cause British trade to expand. The concentration of United States and Continental European competition on this, one of the few large open markets left, with the concurrent development of local industries, has largely transferred the market place of the Argentine import trade from the centres of production to Buenos Aires. The penetration of American goods, which is the most obvious change in Argentine post-war commerce, was brought about by American salesmen taking them to Argentina, and not by Argentine merchants discovering their merits and saleability in the United States. Outside the British Empire, the Argentine market is one of the few with a large import trade offering the best prospects for an increase in the British share. Although we are not favoured, as in the case of the Empire, with a population of British origin familiar with British goods, we have considerable advantages over our competitors derived from the huge British capital investment in the Republic, we have the goodwill of the Argentines towards British goods at a competitive price, and we have an unrivalled organisation for trade. There can be little doubt of the economic capacity of the Argentine Republic to take an even larger share in the world's commerce. She has a steady and growing export trade mainly of the necessaries of life, thus being assured of a market. The import figure is high despite the general low standard of living of the masses of the people. The demand for industrial plant and raw materials has increased steadily, and will progress at a higher rate with the growth of manufacturing industries. There is no definable limit to the requirements for material for public works such as electricity supply, ports, railways, &c.

Prospects for British Trade.

After dealing with the setback to British trade engendered by the coal dispute, Mr. Chalkley says that determined efforts are being made to regain business by many British manufacturers. If these efforts are not relaxed, and are supplemented by visits for the purpose of acquiring a greater familiarity with the requirements of the market and the nature of foreign competition, British trade to Argentina can be increased. The price factor is still the dominant feature of competition, and therefore the chief difficulty confronting British agents. The demand for cheapness does not preclude a concurrent and insistent call for something new, or better, if offered and exhibited on the spot. Argentina, in common with the rest of South America, has had the reputation in the United Kingdom of being a market with which trade has to be conducted very largely on a credit basis, accompanied by a certain degree of risk. It is so still, and the risk of loss seems to have increased with the intensity of competition. The usual 90 days' credit is often extended to four, five, and even six months. This form of trading is not to be recommended save in the case of long-standing connections with first-class firms, inasmuch as it would give the importer too much scope for delaying payment by raising what are frequently trifling claims lodged solely for obtaining concessions when the market or the course of exchange has moved against him.

Methods of Doing Business.

The increased intensity of competition and the greater risks of credit trading have enhanced the importance of the local agent, and due regard must be paid to him. Adequate remuneration and the fullest assistance should be afforded him. On the other hand, the agent should be selected with the greatest care. Nowadays it is essential that he shall possess a knowledge of his principals' and their competitors' goods. A "catalogue engineer" has little chance against the well-equipped representatives of German, Belgian and American firms. Once again Mr. Chalkley reminds manufacturers that catalogues should be printed in Spanish. If possible they should be addressed separately to interested individuals as parcels of catalogues are subject to duty. British branded goods are insufficiently advertised in Argentina. Advantage should be taken of the prevailing good feeling towards British goods to advertise on a more extensive scale, as that preference cannot be relied upon to cause buyers and importers to seek out British goods. Advertising should be locally organised and supervised, and it should correspond to local conditions. Printed matter should be prepared in Argentina, that prepared elsewhere being generally unsuitable.

Electrical Imports.

Appendixes to the report show that the total value of electrical machinery and materials imported into Argentina during 1926 was 23,374,555 gold pesos (£4,674,910) as compared with 18,121,059 gold pesos (£3,624,210) in 1925. This class of goods is divided into two general heads, and the countries of origin are given with the weight of the imports from each. The figures are as follows:—

	1925. Kg.	1926. Kg.	Inc. or dec. Kg.
Wire and cables—			
Total ...	8,613,850	13,493,447	+4,879,597
From Germany ...	3,220,459	6,240,414	+3,019,955
,, United Kingdom	3,310,836	4,351,541	+1,040,705
,, United States ...	815,0.6	735,683	− 79,353
,, Italy	644,753	1,381,252	+ 736,499
Dynamos and electric motors—			
Total ...	3,633,281	3,969,747	+ 336,466
From Germany ...	1,873,010	2,378,607	+ 505,597
,, United Kingdom	525,607	358,579	− 167,028
,, United States ...	424,150	372,302	− 51,848
,, Italy	280,816	206,029	− 74,787
,, Sweden	182,860	304,057	+ 121,197

The majority of the large electric power undertakings are of other than British ownership, and their tendency is to purchase from their own countries. Similarly the United Kingdom secures the bulk of the orders placed by the British railway companies. There are over 500 power plants, large and small, scattered throughout the Republic, and local branches of German manufacturers supply the bulk of their equipment largely by financing on long-credit terms and giving technical service and advice. Italian firms work on similar lines, and are helped by the fact that the majority of the electricians in the country are of Italian nationality. There are now three Italian manufacturing plants in the country and one small German factory. The leading British, United States, German and Italian manufacturers maintain selling branches, which, of course, purchase only from their principals and associates. British prices compare more or less favourably with American prices, and the most severe competition is therefore from the Continent, principally Germany.

Electrical Development and Communications.

The supply of electricity in Buenos Aires is in the hands of two large companies, the Cia. Hispano-Americana de Electricidad and the Cia. Italo-Argentina de Electricidad. During 1926 the former company sold 450,735,961 kWh, of which 125,753,505 kWh was supplied for industrial and other power, and 86,993,173 kWh for tramways. The present capacity of the plant is 242,620 kW, and two new sets which are being installed will add 84,000 kW to this figure. In addition, the company is erecting a "super-station" in the new port of Buenos Aires. This will house 12 sets, with a total capacity of 630,000 kW; the boilers will be fired with oil or pulverised coal. The Italo-Argentina Company generated 108 million kWh during 1926. It also proposes to erect a large station in the new port in three 100,000-kW sections.

Four companies run tramway services in the city of Buenos Aires, but the Anglo-Argentine Tramways Co., Ltd., overshadows the others. It has a route-mileage of 638 km. (including 13.5 km. of subways) out of the total of 840 km. for the four companies. The traffic congestion in the city has reached formidable proportions, but the partial solution, the construction of underground railways, still hangs fire. The Anglo-Argentine Tramways Co. has a scheme, but the Municipality is apparently unwilling to allow the company to charge the increased fares which alone would enable it to undertake the work with any prospect of a return.

The radio services of Argentina are in the hands of the Transradio Internacional, formed by the principal British, German, North American, French and Italian radio companies. The equipment now consists of two long-wave and four short-wave transmitters working directly with New York, London, Paris, Rome and Rio de Janeiro. Some of the short-wave transmitters are adapted for telephony and, with additional equipment, for telephotography. The beam station at Dorchester was completed in 1927, and this is to replace the Ongar station which now handles Anglo-Argentine traffic.

The broadcasting service is poor owing to there being no system of financial contribution by listeners or the trade. The Buenos Aires municipality has erected a 6-kW station. With a higher standard of broadcasting there would be a great increase in the sales of apparatus; even under existing conditions a fair demand exists. Some 60 per cent. of the receivers in use are constructed from imported parts; the better-class sets come mainly from the United States.

The largest and only important telephone undertaking in Argentina is the United River Plate Telephone Co., Ltd. During 1928 the company intends to erect a new 14-storey exchange with an initial capacity of 8,000 lines, to be raised ultimately to 30,000 lines. Equipment for 3,000 new automatic lines is to be installed in Buenos Aires in extension of existing exchanges. Future projects include the laying of an underground cable from Buenos Aires to Rosario.

The Work of the Electricity Commissioners.

Annual Report.

(*Concluded from page* 1149.)

Special Orders.

DURING the year 85 applications for Special Orders were received, making, with 88 brought forward (of which two were divided into two parts), a total of 175 applications under consideration. Special Orders were made in respect of 70 applications, 5 were refused, and 5 withdrawn, leaving 95 to be carried forward. Local authorities made 15 applications in respect of new undertakings, and 18 for extensions of existing areas; companies made 37 applications in respect of new and 13 in respect of existing undertakings. Twenty-nine applications were competitive, and twelve inquiries (affecting 22 applications) were held.

Borrowing by Local Authorities.

At the commencement of the period covered by the Report, 189 applications for sanction to borrowing were under consideration, and during the year 635 further applications were received. Sanctions were issued in 626 cases. Allowing for 16 applications otherwise dealt with, 182 applications remained under consideration at March 31st. The total amount of the loans sanctioned was £15,381,434, an increase of nearly 60 per cent. on the figure for the preceding year, and the largest amount recorded in one year. Of the £84,676,780 sanctioned in the course of seven years, approximately 45 per cent. was for the provision of plant, and about 37.5 per cent. for mains and services. The largest amount sanctioned in the case of an individual authority, namely, Birmingham Corporation, was £2,218,300, largely for works in connection with the new generating station at Hams Hall. Sanctions amounting to £500,000 or over were issued to the Corporations of Edinburgh, Leeds, and Manchester.

The amount sanctioned in 1926-27 included sums of £266,122 in respect of wiring installations for consumers' premises, and £134,819 for the purchase of domestic apparatus and appliances to be let on hire; these figures show a substantial increase on those recorded in the previous Report.

The Commissioners found it necessary to reconsider the question of the loan repayment period to be allowed, in cases involving the installation of generating plant in stations which might cease to be used as generating stations in the near future owing to supplies in bulk becoming available. The past practice was to allow a repayment period not exceeding 15 years as a maximum in such cases, but in view of the Act of 1926, the Commissioners concluded that cases would arise in which it would be difficult to justify a longer period than 10 years.

The Commissioners have decided to continue to sanction a repayment period of 10 years in respect of moneys borrowed for the wiring of consumers' premises and the provision of motors, and seven years in the case of domestic apparatus and appliances; sums in excess of loan repayments which are received from consumers are to be applied in reduction of the loan.

With regard to the relief of local rates, the Commissioners are advised that, in order to arrive at the "outstanding debt" of the undertaking, under the Act of 1926, the amount of any sinking fund provided for the redemption of debt should be deducted.

A Memorandum was issued in February, 1927, dealing generally with the procedure to be followed in making application for sanction to borrowing, and with the nature and extent of the information which should be submitted in connection therewith. In the case of prospective unspecified works not constituting a definite scheme of development or extension, the Commissioners are prepared to entertain applications covering the estimated requirements of the undertakers for a period not exceeding three years.

Mutual Assistance: Bulk Supplies.

With regard to arrangements for mutual assistance falling within the scope of Section 19 of the Act of 1919, the Act of 1926 removed the necessity for a Special Order, and enabled powers to be conferred by a departmental Order. Important bulk supply developments took place or were initiated during the year under review, bringing the total number up to 351 (local authorities, 199; companies, 152). As compared with the previous year, there was an increase of 22 in the number of bulk supplies taken or arranged for. In the case of supplies (314) taken or arranged to be taken from authorised undertakers, the bulk suppliers numbered 77 local authorities and 42 companies.

During the year the Commissioners gave their approval in 32 cases to arrangements for mutual assistance or for bulk supplies.

Fringe Orders.

The Commissioners granted 119 Orders during the year permitting various authorised undertakers to supply electricity to specific premises situated outside their respective areas of supply.

Systems of Supply: Regulations.

The Commissioners issued 19 consents to alteration in the declared system and/or pressure of supply. They served Notices and prescribed Regulations for securing the safety of the public and for the protection of the electric lines and works of the Postmaster-General in 22 cases where electric lines and works had been erected or laid down without statutory authority.

Requisitions by Prospective Consumers.

Two appeals were made by authorised undertakers for a variation of the requisition provisions, one by a company undertaker and one by a local authority undertaker. After reviewing all the circumstances, the Commissioners came to the conclusion that a sufficient case had not been made out by either of the undertakers to justify variation.

Subscriptions to Associations.

The Commissioners issued 14 consents in respect of the payment of subscriptions to and/or expenses of attendance at meetings of the British Electrical Development Association (Inc.); the British Engineering Standards Association; the Incorporated Municipal Electrical Association; and the British Electrical and Allied Industries Research Association (Inc.).

Returns and Statistics.

In November, 1926, the Commissioners published their Second Statistical Return embodying engineering and financial particulars for the years 1923-24 and 1924-25 in respect of all authorised electricity undertakings in Great Britain. An effort was made to expedite the preparation of the Third Return covering the year 1925-26 with the view of publication in the early summer of 1927, but this was not found possible. The exceptional pressure of work also delayed the issue of the Annual Return for the year ended March 31st, 1926, as to fuel consumption, units generated, &c. This return was issued in May, 1927.

Transfer of Undertakings.

Under the provisions of 15 Orders the Commissioners gave their approval to Deeds for the transfer of the undertakings authorised by the Orders. Two other transfers took place under Provisional Orders.

Overhead Lines.

A noteworthy feature of the past year was the very large increase in the number of applications for consent to the erection of overhead lines. As many as 328 applications were dealt with by the Commissioners during the year, representing an increase of nearly 70 per cent. on the number dealt with in the preceding year. In 120 cases the applications were from local authority undertakers, in 104 cases from electric power companies, and in 104 cases from other company undertakers. At March 31st the Minister had given his consent in respect of 324 applications.

Wayleaves.

During the year the Commissioners dealt with 53 applications, as compared with 24 in the preceding year. In six cases, the parties concerned arrived at a settlement. In 45 cases, after local inquiries had been held, the Minister gave his consent to wayleaves in 44 cases and refused it in the other. The wayleave rentals prescribed were generally of the order of 2s. 6d. for each pole leg on arable or mowing land, and 1s. in other cases, with 6d. per stay, but in some cases the rentals were as much as 8s. per double pole and 4s. per single pole that impeded arable farming. The total number of applications made to the Minister for wayleave consents during the past seven years was 95, of which 49 were received during the year ended March 31st, 1927.

Revocation of Powers.

During the year the Commissioners recommended the Minister of Transport to make an Order for the cesser of the powers of the undertakers under the North Western Electricity and Power Gas Act, 1903, and to revoke the Ormskirk Gas and Electricity Act, 1915, in so far as they related to the supply of electricity.

Compensation for Loss of Employment.

Claims for compensation were preferred under the Electricity (Supply) Acts and awards made during the past year by the Referee appointed by the Minister of Labour:—

Claims were preferred against the Ayrshire Electricity Board by four employés who had been in the service of the Ayr Undertaking and had been retained by the Board but subsequently dismissed. The Referee awarded a total sum of £1,106 in respect of the four claims. Further claims for compensation were made by two female employés, and a total sum of £83 13s. was awarded.

The Corporation of Gillingham entered into an arrangement with the Kent Electric Power Company for a partial bulk supply, and ceased to generate electricity to the same extent as before. As a result, certain employes engaged in the generating station were discharged, and the Referee awarded a total sum of £193 in respect of claims by four employés.

Claims preferred against the Brompton Company by seven employes on the ground that they had suffered loss of employment in consequence of an agreement made between the Brompton Company and the London Power Company were disallowed.

Organisation of Electricity Commission.

The period under review was one of exceptional pressure upon the time of the Commissioners and their staff, which numbered 66 in all at March 31st, 1927, and consisted of 35 established officers and 31 unestablished and temporary officers.

At the beginning of the financial year the Commissioners submitted to the Minister of Transport an estimate of their receipts and expenditure for the year 1926-27. The estimated net cost of administration was £61,300, and after allowing for a reduction of £10,300 in the working balance, the total amount to be apportioned among authorised undertakers was £51,000, as compared with £53,000 in the preceding year. This estimate was approved by the Minister. The certified returns submitted for the year ended December 31st, 1925, showed that 5,515,345,364 kWh was sold by authorised undertakers in Great Britain during that year. The contributions by the electricity supply industry towards the expenses of the Commissioners for the year 1926-27 thus involved a payment amounting to 2.23d. per 1,000 kWh sold by each authorised undertaker concerned.

The net expenditure fell short of the estimate by approximately £20,000.

Numerous appendices, occupying 88 pages, give particulars of the proceedings under eight Electricity District Orders, consents for extensions of plant and mains, Special Orders, loans sanctioned, systems of supply approved, non-statutory undertakings, Fringe Orders, guarantees under the Trade Facilities Acts, and the electricity fund account.

Application of Electricity Acts to Central Board.

In the Report the Commissioners point out that the Central Board is deemed, by Section 20 of the Act of 1926, to be an undertaker within the meaning of the Electricity (Supply) Acts, and the provisions of the schedule to the Electric Lighting (Clauses) Act, 1899, are therefore to be incorporated with the Act of 1926, subject to modification by the Commissioners. The latter proceeded on the broad principle that the machinery of the Board should be rendered as simple as possible; consequently they removed many of the minor provisions of the Clauses Act. The Regulations thus compiled were signed on June 1st, 1927, and laid before Parliament for 30 days, and came into force on November 10th, 1927. They were issued on December 22nd by H.M. Stationery Office (Statutory Rules and Orders, 1927, No. 1,144. Price 5d. net.)

Radio Manufacturing in America.

The Enforcement of Patent Royalties.

IT is probable that in the near future the average American manufacturer of receiving sets will lose the immunity from patent royalties hitherto enjoyed, and that he will be compelled to pay royalties to the holders of the patents embodied in the construction of radio apparatus.

Apart from the neutrodyne patents (under which fourteen manufacturers pay royalties to the Hazeltine Corporation), the great body of American wireless patents are controlled by the Radio Corporation of America, and this company is now taking energetic action against manufacturers and dealers trading in sets which infringe any of its patents. For the growing number of manufacturers who think it safer to regularise their position by concluding an agreement, a standard form of licence is issued. Many of the terms strongly resemble the manufacturing licence which is used in this country, but some of the conditions are much more stringent. The following is a brief summary of the American form of agreement, from which it will be seen that costs and prices may be materially affected by many of the conditions:

1. The licence is non-transferable, and applies only to the manufacture of instruments of the tuned radio-frequency type for broadcasting and experimental work in the United States.
2. The meaning attached to broadcasting and experimental uses is more fully defined, and a definition is given of "tuned radio-frequency." Royalty is stipulated upon the net selling price of receivers complete with all accessories.
3. The amount of royalty is fixed at 7½ per cent., and a minimum royalty payment of $100,000 per annum is stipulated.
4. Statements must be submitted by the licensee to the R.C.A. every quarter-day, and the royalty shown to be due must be paid within 30 days thereafter. In the case of the last quarter of each year, the extra amount must be included which is necessary to bring the yearly payment up to the prescribed minimum.
5. Inspection of the licensee's books is permitted.
6. A plate must be affixed on all instruments showing the purposes for which it is licensed, and a similar statement must be included in the advertisements and catalogues of the licensee.
7. The licensee admits the validity of the R.C.A. patents and rights, and undertakes not to contest them.
8. The licence is expressly confined to the use of the American patents enumerated, and foreign patents are excluded.
9. Super-heterodyne receivers are expressly excluded from the terms of the licence.
10. Protection is granted to the licensee in connection with litigation pending in connection with the Armstrong patent No. 1,113,149, whatever may be the outcome of the case.
11. The licence ceases in the event of any non-observance of the terms by the licensee.
12. Bankruptcy or the appointment of a receiver for the assets of the licensee brings the licence to an end.
13. The manufacture of valves is expressly excluded. Each receiver sold must be equipped with a complete set of valves of R.C.A. manufacture.
14. Patents held by the licensee shall also be available for use by the R.C.A. upon reasonable terms.
15. The sum payable to the R.C.A. by way of damages for infringement of its patents prior to the issue of the licence, is set forth, together with the manner of payment by instalments up to 1932.

The points which will strike the English manufacturer and trader are the exclusion of the super-heterodyne circuit, the large minimum royalty stipulated, and the demand for back royalties. So far it is only the very largest makers who have concluded an agreement upon these lines, but one of the licensees is an amalgamation of five smaller concerns.

It is probable that the policy and charges which are set forth in the R.C.A. licence which is summarised above will result in considerable increases in American prices, and that the effect will be widespread. Meanwhile, the general American view is that 1928 will be a bad year for the smaller class of wireless set manufacturer who cannot pay $100,000 per annum plus back royalties or, alternatively, who cannot afford to brief a small army of lawyers.

Legal.

Vacuum Cleaner Salesman Charged.

AT the Ilfracombe Police Court recently, Alexander L. B. Watt was charged with obtaining £2 2s. 6d. commission from his employers, Electrolux, Ltd., by false pretences. It was stated for the prosecution that Watt had sent in orders for vacuum cleaners purporting to come from customers and drew the commission upon them, whereas no orders had actually been received by him. The defendant, who pleaded "Not guilty," said that the trouble was due to his over-confidence that the orders would be received in due course.

The chairman of the bench considered that he had acted in a very irregular manner but without fraudulent intent. The case was therefore dismissed.

Workmen's Compensation Case.

IN the Bow County Court, on December 22nd, before Judge Hargreaves, an application was made by Mr. A. E. Pratt, on behalf of Cecil H. L. Edwards, of East Ham, for an award under the Workmen's Compensation Act of 30s. a week for total incapacity, against the Swedish General Electric, Ltd. On April 29th, the applicant was working as a testing engineer and in pursuance of his employment, was riding a bicycle in the neighbourhood of Sidcup, when he collided with a motor-car, fractured his right leg, and he had since been totally incapacitated. At the time of the accident his wages were £3 10s. a week.

Judge HARGREAVES made an order for the payment of 30s. a week up to date, and to continue during incapacity.

Ether Drift.

The latest repetition of the Michelson-Morley experiment, which is described by K. K. Illingworth in a recent issue of the *Physical Review*, has yielded a null result, no ether drift being recorded greater than one kilometre per second, the probable error of the measurements. The experiments were performed in the California Institute of Technology at various times during the summer of 1927, and included runs made both under isothermal conditions and with slow progressive changes of temperature the effect of which could be eliminated in the final analysis of the observations.—*Nature.*

High-Pressure Cable Testing.

Apparatus developed by Messrs. Watson & Sons (Electro-Medical), Ltd., for providing rectified current at pressures up to 400,000 V.

DURING the past few years Messrs. Watson & Sons (Electro-Medical), Ltd., have given considerable attention to the production of apparatus for h.p.-cable and overhead-line testing, and have succeeded in designing, it is claimed, a satisfactory equipment in which hot-cathode valves are used for the rectification of high-voltage a.c. The use of a.c. to carry out the tests on long-distance transmission lines is, of course, precluded by the great difficulties of transportation to the site of test of the plant capable of generating or transforming the necessary power.

The principle upon which the hot-cathode valve depends for its operation is that a highly evacuated space containing two metal electrodes, one incandescent and the other comparatively cold, possesses a unidirectional conductivity and passes current through the tube only when the heated elec-

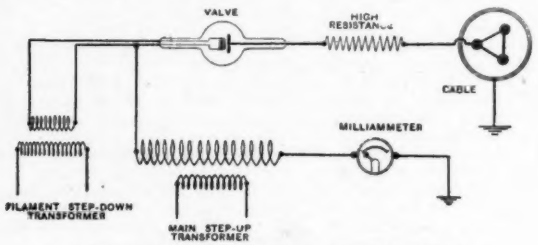


Fig. 1.—One-Valve Test, 3 Cores to Earth.

trode or cathode is negative. The cathode consists of a filament rendered incandescent by the passage of current from a source of supply carefully insulated for the pressure to which the cable is to be tested.

Fig. 1 shows the method of using one valve for a high-pressure test between the three cores of a cable and earth. The anode of the valve is joined through a high resistance to the cores of the cable. Single-valve tests can be carried out at a pressure of 100,000 V with a special type of valve, but as a rule, if the test pressure is to exceed 40 or 50 kV, two valves are used. When using one valve only one-half of the a.c. wave is utilised, and the condenser formed by the core and sheath of the cable becomes charged to a pressure equal to the peak value of the secondary voltage of the transformer. When the pressure reverses the charged cable applies an equal pressure in the opposite direction; hence the valve must be constructed to withstand a pressure of twice the peak value in the direction of the filament to the anode. Modern valves are constructed to withstand reverse pressures up to 200,000 volts (max.).

When an alternating pressure is applied to a cable any moisture in the insulation remains stationary, but when a

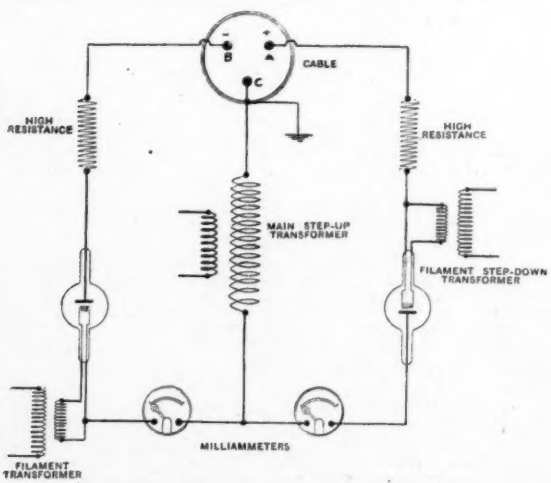


Fig. 2.—Core-to-Core Test, 2 Valves.

d.c. pressure is applied the effect of osmosis is introduced, and the moisture tends to move to the negative conductor. The accepted practice in a core-to-earth test is to make the core negative by joining it to the anode of the valve, and any moisture in the cable tends to migrate to the core, thus rendering the direct pressure test more severe than is at first sight apparent. The single-valve method of testing has two disadvantages which the use of a second valve eliminates: The core-to-core test pressure may not exceed the core-to-earth test pressure; and the maximum reverse peak voltage across the valve is twice the test pressure. With comparatively low pressures of, say, 20 or 30 kV, the first-named is often unimportant.

Fig. 2 shows the method of connection for a core-to-core test by means of two valves. This is in effect a single-valve test upon each of the cores A and B, the core C being earthed or left floating as desired. It will be seen that there is a pressure of twice the peak value between the cores A and B, and the core-to-earth pressure of these two conductors is one-half of this value. In practice the most accurate reading of the test pressure is that given by an electrostatic voltmeter directly connected across the cores.

It may be required to test between core and earth at a pressure less than the test pressure between cores A and B, but greater than one-half this value; the connections shown in fig. 3 would give these conditions. The test pressure of core B to earth and core A, by controlling the primary circuit of the main transformer, can be given any required value.

The advantages arising out of the use of the two-valve system of testing are: The reverse peak pressure applied to the valves does not exceed the test pressure; and the core-to-core test pressure may exceed the core-to-earth test pressure.

D.c. pressures up to 200,000 V can be obtained by means of the two-valve arrangement, but to obtain pressures greater than this it is necessary to use condensers and join a two-valve circuit and another single-valve or two-valve circuit

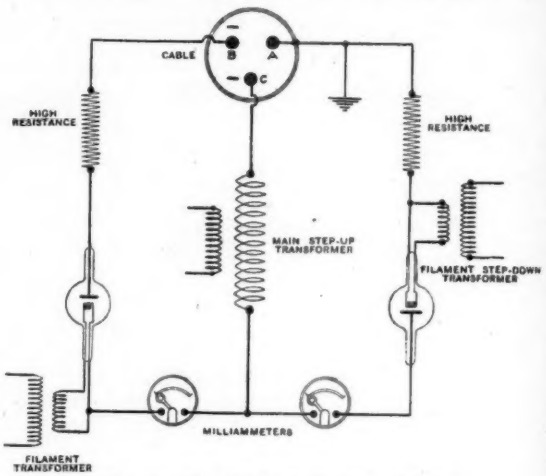


Fig. 3.—Core-to-Earth Test, 2 Valves.

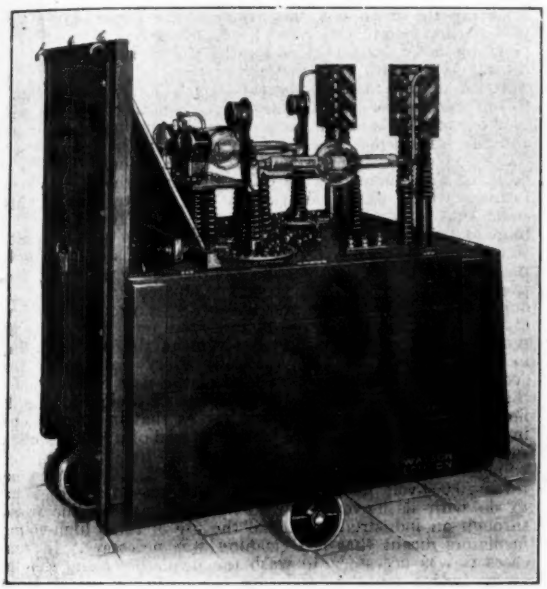
in series. With this arrangement a maximum direct pressure of 400,000 V can be obtained.

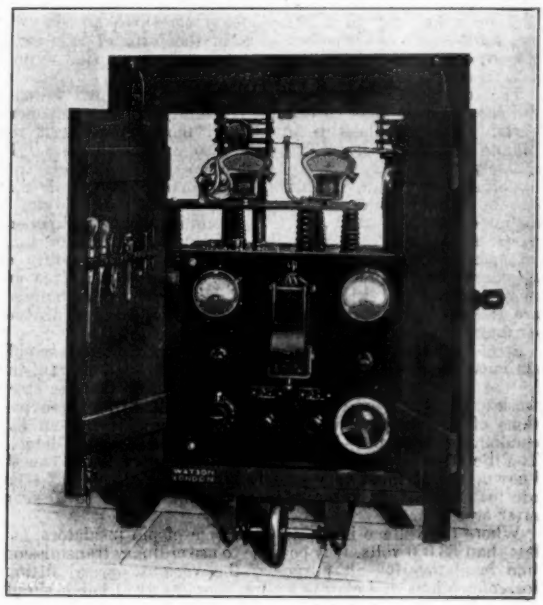
Messrs. Watson & Sons are producing "Sunic" testing sets for cables and overhead lines in portable form in a single transport cabinet for core-to-core tests at up to 100,000 V. They are completely wired so that the only connections required on the site of a test consist of two leads from the l.p. a.c. supply, the h.p. leads to the cable, and a connection for earthing all metal parts of the equipment other than the circuits. When a pressure greater than 100,000 V is required, however, the main transformer is housed in a separate transport cabinet, and two extra connections are required when a test is to be carried out. The transport cabinets, figs. 4 and 5, each contain the main transformer; filament transformers; valves and valve holders; resistances of the order of ½ meg. for the h.p. circuits for protecting the valves in the event of a breakdown in the cable under test; a switchboard with all the necessary switches and controls in the main circuit for the gradual application of the test pressure, and in the filament circuits for the control of the filament currents; meters for the measurement of primary voltage and current, filament voltage, and of leakage current through the cable insulation; and all auxiliary apparatus that may be required in carrying out a test from start to finish.

The cabinets are constructed of well-seasoned deal 1¼ in. thick, tongued and grooved at all the joints, and are reinforced with wrought-iron straps and provided with hooks and chains for slinging. They are equipped with hinged half sides and removable top, and 7-in. diameter rubber-tired wheels. For the measurement of the test pressures an electrostatic voltmeter is recommended, and multi-range instruments can be provided for measurements up to any required pressure.

The testing equipment illustrated is designed to give a maximum d.c. pressure of 100,000 V between cores, and 80,000 V from core to earth; test sets for other pressures are mounted in a similar manner.

The cabinet is suitable for sets giving pressures up to 150,000 V, but for voltages higher than this, if portability is desired, the equipment is best built into a trailer van or motor chassis.





Figs. 4 and 5.—"Sunic" Testing Set for 100,000 V, Side and End Views.

By means of a special type of control the test pressure can be raised gradually to any required value within the capacity of the set. Milliammeters are provided to indicate the current leaking through the insulation of the cables, usually a fraction of a milliampere.

For discharging the cable a device is provided consisting of an ebonite rod about 3 ft. long with a metal hook at one end which is arranged to be connected to earth by means of a flexible wire. To the hook is attached a length of damp cotton tape; by holding the rod so that the end of the tape touches the lead to the charged core, the initial discharge is made through a high resistance. By allowing the earthed hook gradually to approach the h.p. lead, keeping the tape in contact with it at the same time, the cable is eventually discharged. After discharge the cable should be connected to earth and allowed to remain so for some hours to prevent danger of shock due to "residual effect."

The resistances in the h.p. circuit consist of a number of 50,000-ohm units, which, for an ordinary pressure test, are connected in series, giving a resistance of the order of ½ megohm in series with each valve.

Some earlier models of the hot-cathode valve testing sets by Messrs. Watson were described in the ELECTRICAL REVIEW, January 8th, 1926.

The High-Voltage Sub-Station.

Comparative design and equipment features of indoor and outdoor sub-stations working at pressures of from 22 kV upwards.

By C. E. ATKINSON.

(Abstract of a Paper read before the ASSOCIATION OF MINING ELECTRICAL ENGINEERS.)

THE paper discusses the design and equipment of sub-stations for voltages from 22,000 up to the highest value at present in use, with special reference to British practice. Small transformers were, until recently, regarded as being more liable to breakdowns than large units, but improvements in the windings have made much smaller transformers possible, and 33,000-volt units of 5-kVA capacity can now be made.

Dismantling an ordinary self-cooled transformer on site involves the breaking of a large number of the oil-tight joints, but this can be avoided by connecting all the radiators together to form a single cooling unit. Slightly more cooling surface is required, but the arrangement has the advantage that two joints only have to be broken to remove the transformer.

Recently, some large transformers of the self-cooled type have been built with small fans arranged to blow air through suitable piping on to the tubes at certain points. The rate of heat dissipation is quickened, and less cooling surface is therefore required. If the fan breaks down the transformer can still be operated as a self-cooled unit with a reduction of about 40 per cent. in its capacity.

The switchgear for the 66,000-volt transmission lines which have been built in England is of the outdoor type, and in those cases where the switchgear is not being fitted at present, the lay-out is arranged on the assumption that outdoor switchgear will be used. Where each circuit has to be controlled by an oil switch the financial advantage gained by using outdoor switchgear is practically negligible, and if the measuring instruments are connected on the h.p. side, the balance would probably be turned in favour of indoor gear. Outdoor gear at 33,000-35,000 volts is markedly cheaper if some of the circuits can be controlled by air-break switches only.

It is a case, then, of balancing the advantages of outdoor gear with the greater reliability and ease of working of indoor equipment.

A sub-station is a developing organism, and it is important, when commencing the design, to have a clear understanding of the extensions which will have to be made, and to know the successive stages by which the final arrangement will be reached. Only by attention to these matters can the most economical lay-out be obtained. Sub-stations can be conveniently divided into those with outdoor switchgear and those with indoor switchgear. Outdoor transformers are almost invariably associated with outdoor switchgear, so that the difference between the two types is that, in the one case the building is relatively small, and in the other it contains most, if not all, of the apparatus.

The ideal arrangement for an indoor substation is to have the h.p. and l.p. switchgear in different rooms, and to operate them from a third room. All these compartments should be separated by fire-proof partitions. Sub-division is always desirable with switchgear operating at voltages of 33,000 and upwards, but as a general guide the author would suggest that in all cases where the switchgear has a rupturing capacity of 250,000 kVA or more, it should be housed in a separate compartment and be controlled from a distance.

It is better to be lavish rather than niggardly in the dimensions of buildings, so that unexpected additions, such as extra switchgear units or transformers of larger capacity, can be accommodated without any difficulty. The quantity of air required by a large self-cooled transformer is not generally realised; one kilowatt-second will raise the temperature of 28 cubic feet of air 1 deg. C., so that a transformer of 7,500 kVA, having losses at full load of about 100 kW, will raise the

temperature of 280 cubic feet of air 10 deg. in one second. To limit the rise of temperature between the air inside and that outside the transformer chamber to this figure, 16,800 cubic feet of air, or a volume of 40 ft. by 21 ft. by 20 ft., must be completely renewed every minute. The difficulty of supplying this quantity of air through a restricted opening can be realised.

Where a transformer has to be completely enclosed the air inlet should be in the floor under the transformer, so that the incoming cold air can have easy access to all sides of the tank. Where the opening is in the form of louvres in the lower portion of the door, for example, the side remote from the door does not get proper ventilation.

The advantages of the outdoor sub-station for high voltages are cheapness in first cost and accessibility of the component parts. The cheapness is in general more pronounced the higher the voltage, and depends also on the locality. In sparsely populated regions, where access is difficult and materials and labour expensive, a supporting framework that can be factory-made and transported in pieces to the site is an important advantage. The accessibility of the component parts is better when compared with cubicle gear for high voltages, which occupies several floors. The possibility of a general fire is practically eliminated, and partial fires are more easily dealt with than in a building. The disadvantages are the amount of ground space occupied, and the difficulties of maintenance in bad weather.

Steel is the most frequently used material for outdoor sub-stations, but corrosion is a difficulty. At present galvanising by the hot process is considered the best protection for steel-work, but the expense can be lessened by painting those portions of the framework which are sufficiently far from live conductors to admit of their being painted without danger. The life of galvanised structures in this country is not exactly known, and it must vary greatly with the locality, but there are instances of steel towers in good condition 17 to 20 years after erection.

Where the voltage is within the range of pin insulators, *i.e.*, less than 88,000 volts, it is possible to use ordinary transmission-line insulators for all purposes, the various special fittings for connections or isolating switch contacts, &c., being simply clamped on to the head of the insulator. It is possible, therefore, for a supply authority, if it so desires, to use the same porcelains on the sub-station as are used on the transmission lines. In practice, however, this is not often done, as the sub-stations are frequently insulated for a higher voltage than the lines connected to them.

In considering the size of insulator to be used, allowance should be made for the locality, as proximity to the sea, factories, large towns and similar places, where deposits are likely to be formed on the insulators, reduces the flash-over voltage, and a similar effect occurs where pin insulators are used in horizontal or inclined positions.

Where switches and transformers rest on concrete foundations a large trench can be formed in concrete round each unit. In the case of any accident oil would then flow into this trench and not spread over the site. All these trenches should be drained to an underground oil sump, which should have a capacity equal to the largest transformer tank.

Within the next few years there is no doubt that high-voltage engineering will make great advances in this country, and many engineers will have to become accustomed to the use of voltages far in excess of those which they have been previously acquainted with. Until quite recently this branch of engineering has been developed only in other countries, but it is to be hoped that the next few years will see this reproach removed, and British products and designs attain a supremacy in the high-voltage field similar to that which they enjoy in other branches of engineering.

Discussion.

During the discussion following on the paper, Mr. J. R. COWIE (hon. branch secretary) referred to the difficulties of handling large transformers on the railways, and from the railway to the site. He understood that in Germany and in America certain instructions had been laid down with regard to big transformer floats. They might consist of a bogie with four or six wheels and a frame on which the transformer sat, and the transformer itself took the tie from the centre of the conveying bogie. Some such float as that would have to be designed and constructed in order to handle the heavy transformers which would be used in this country. He understood that many transformers would weigh round about 30 tons, and consideration was actually being given to transformers weighing as much as 50 tons. The possibilities of haulage by road had also to be considered. Another point was that these transformers could not be properly prepared on site, and the only thing for a big job was a central transformer-handling outfit. Referring to the use of insulators on outdoor installations, he said he had inspected several of the overhead lines in this country, and, in practically every instance of very good practice, insulators were used of the next voltage above that for which the line was supposed to be designed. He did not think they would go quite so far as that in America, but in many instances they were using material of a higher voltage capacity than that normally specified for the particular voltage of the line. In a recent case a 22,000-volt line had three 20,000-volt insulators on it. One reason for that had to do with flash-over. The other was that the line passed through an industrial area, and the use of these high-voltage insulators meant that less cleaning was necessary. In some cases it was necessary to wash the insulators along the line every twleve months, and in other instances at longer intervals, depending on the atmospheric conditions in the locality.

Mr. ATKINSON, in replying to the discussion, said that one could not get away from buildings, even in outdoor sub-stations. It was the custom to operate the switches electrically, and the control gear was housed in the building which contained batteries, motor generators, and other auxiliaries. With regard to telephonic communication between two sub-stations considerable distances apart, he said that the system of telephoning along the line wires was in practical use. The decision as to whether to adopt carrier current, a special line or a Post Office line depended upon the circumstances in each particular case. As to the properties of the disks of the suspension insulator on jobs with which he had been associated, the dry flash-over was about 80 kV per disk; the wet flash-over was about 50 kV, and the puncture about 100 kV. A 66-kV line could be done comfortably with four disks per insulator, but it was usual to place five at important positions. For 132 kV, he believed that about ten disks were required. The increased protection was not proportional to the increase in the number of disks. Two or three were not two or three times as good as one, because of the increased losses.

Industrial Illumination.

An Investigation of Electric Lighting in the Engineering Industry.

(*Abstract of a Paper read before the* ILLUMINATING ENGINEERING SOCIETY.)

MR. J. L. H. COOPER, B.A., A.M.I.Mech.E., A.M.I.E.E., on behalf of the Lighting Service Bureau of the Electric Lamp Manufacturers' Association, has carried out an investigation covering a period of some months in a large industrial area with the object of collecting practical data and making suggestions which it was hoped would assist in furthering the interests of industrial illumination. Observations were carried out in large and small works and, owing to the variety of different industries involved, these may be taken as representative of lighting conditions generally in the metal trades; interviews with executives were sought, and their attitudes and opinions recorded.

Generally, the attitude towards the adoption of better lighting was found to be good: employers commonly remarked "we believe in providing our men with plenty of light," but this did not always indicate the installation of a modern system of lighting. The "plenty of light" referred to was often the result of substituting modern lamps for the older types, whilst retaining the old patterns of shades and positions of the lamps. An analysis of the opinions showed that executives were concerned more with the prevention of accidents and the improvement of hygienic conditions than the increase of output.

In addition to utilising modern systems of illumination, some firms paint machines and sides and legs of benches with grey paint of a fairly high reflecting factor (40 per cent.), which practice is being considered by others. It was noticed that the different forms of "glare" do not seem to be appreciated, judging by the kind of local light used to increase the intensity of illumination. The colour conditions of the walls indicate that in many cases, especially in the older type of workshop, they are whitened in the early spring; it would greatly assist artificial illumination during the winter months if this work were attended to in the early autumn.

The lighting condition in the works investigated could be summed up as follows: Very good, 10 per cent.; good, 6.6 per cent.; fairly good, 13.4 per cent.; poor, 40 per cent.; very poor, 10 per cent.; partly good and partly poor, 20 per

cent. The last-mentioned class is that where a gradual change from an old system to a modern one is going on. The adoption of a modified form of a local lighting system for general purposes was the cause of much poor lighting. Although the bad effects of "glare" were admitted in many cases, no attempt had been made to eliminate it. With regard to the important factor of cleanliness, it was observed that 20 per cent. of the works had clean equipment, 36.6 per cent. had fairly clean equipment, and 43.4 per cent. had dirty equipment; 70 per cent. of the firms employed gasfilled lamps exclusively, 3.3 per cent. used bowl-sprayed gasfilled lamps exclusively, whilst 23.3 per cent. used both gasfilled and vacuum lamps, and 3.4 per cent. employed vacuum lamps exclusively. Few executives were insufficiently familiar with the advantages of opal, white-sprayed, or internally-frosted lamps, and many were under the impression that a considerable amount of light was lost by absorption by the obscuring material. Little or no use had been made of "daylight" lamps in the engineering industry, despite the advantages of such lamps.

In several works a uniform system of electric lighting was employed and all local light dispensed with (except for certain specific processes), and the workmen in particular were loud in their praise of the new system. Very little progress appeared to have been made in the illumination of small machine shops. The provision of general illumination of high intensity appeared to be pre-eminently suitable for the average small workshop.

It was not generally appreciated that the cost of good lighting in both large and small workshops was only 0.86 per cent. of the wages bill, at the most. In the best illuminated works the standard attained at night was found to be 50 per cent. of that obtained during the daytime.

Discussion.

In the discussion which followed, Mr. WERNER, His Majesty's Superintending Inspector for the Midland Division, said that if the general illumination was well planned, no doubt a great number of operations could be satisfactorily conducted with that source alone, but he thought that there must be a number of processes for which local lighting was essential. Mr. Cooper had not referred to the danger of "flattening out" with a system of equally distributed lighting. In such a case it was impossible for an operator to see the fine surface markings and sharp angles which it might be necessary for him to see; in that case local light, in addition, would produce a shadow and so throw up the markings in relief, to the advantage of the worker. In concluding his remarks, Mr. Werner emphasised the great value of the propaganda work for better illumination which was being carried out by the Illuminating Engineering Society.

Another factory inspector, Mr. WARD, also expressed his appreciation of the work of the Society. The prejudice of workmen against modern systems of lighting sometimes had to be dealt with. He thought that in foundries perhaps greater advances in illumination had been made than elsewhere. He hoped that Mr. Cooper would extend his investigations to other trades, which he felt sure would benefit from them, just as the engineering industry had.

Others who joined in the discussion included Mr. J. Eck, Mr. L. E. Buckell, Mr. G. Campbell, Mr. A. Cunnington, Mr. H. Jackson, and Mr. L. Gaster.

The chairman (Mr. D. R. Wilson), in proposing a vote of thanks to the author, referred to the value of the comprehensive data in Mr. Cooper's paper, which aptly illustrated the great field for improvement in factory lighting.

The Klingenberg Power Station.

The new generating station in Berlin is designed for an ultimate capacity of 540,000 kW, and is at present equipped with three 70,000-kW main generating sets and three 10,000-kW feed-heater units.

By O. FELDMANN.

(*Abstract of a Paper read before the* S.A. INSTITUTE OF ELECTRICAL ENGINEERS.)

THE electricity supply undertaking in Berlin was formed as a public share company in 1884. It was the first public supply company in Germany, and was the sole undertaking authorised in Berlin for the supply of electrical energy.

In 1896 the first three-phase power station was built, in Oberschoeneweide, near Berlin, and four years later a new three-phase station was constructed in Moabit. In 1906 a 50,000-kW station was commenced on a site in the suburb of Rummelsburg. When the municipality decided to take over the power company in 1915 the total installed capacity was 160,000 kW.

The difficulty of satisfying the demand for electrical energy during the war and afterwards was very considerable. A large amount of power was bought from power stations owned by the State and situated on brown-coal mines in Central Germany, the energy being transmitted over 100,000-volt transmission lines. The installed capacity of the seven Berlin stations in 1925 was about 206,000 kW, and the total output, including the purchased energy, was about 600 million kWh.

In order to facilitate the management of the undertaking, and particularly to be able to raise capital more conveniently, it was decided, in 1923, to form the undertaking into a company, owned entirely by the municipality. After the inflation period there was a further rapid growth in the consumption of electrical energy and, consequently, about two years ago the municipality commenced negotiations for the construction of a new power station.

The plans for the new station were prepared under the personal supervision of Dr. Klingenberg, whose name the station bears; he unfortunately passed away without seeing his most important work finished. When completed the Klingenberg power station will have an installed capacity of 540,000 kW.

The construction commenced in September, 1925, and the whole station was handed over in May last year. This result was achieved largely by the successful grouping of various classes of sub-contractors and the standardisation of their plant. At times there were 2,000 men employed on the site simultaneously.

Pulverised-fuel working was adopted because of the conditions peculiar to the supply of coal in Berlin, and it was decided to centralise the milling plant and to bunker the fuel. The average moisture contents of the coal used in Berlin vary from 2 to 12 per cent., and in some cases even 20 per cent. of moisture has been measured, necessitating an elaborate drying plant.

It was decided to adopt a steam pressure of 500 lb. per sq. in., with a superheat at the boilers of 425 deg. C. Steam reheating was not adopted, as it was felt that increased complications of the plant would result, accompanied by reduced reliability. The new station is situated close to the River Spree, and near the centre of gravity of the demand. Coal can be delivered either by rail or in barges drawn into a special dock. The principal buildings lie between the railway siding and the main road. There was not sufficient room for the 30,000-volt switch house, which was consequently placed on the other side of the road and connected to the control room adjoining the turbine house by a bridge. The condenser basement and the ash cellar are practically on ground level, and only a comparatively small amount of excavation work was necessary. Reinforced concrete is used for the foundations, which, in the case of the turbines, are mounted on piles, 250 for each set.

The coal which is not milled immediately on arrival is stored in the open. The cooling water for the condensers is obtained through a closed culvert from the river and is carefully strained and cleaned before it reaches the condensers. A straight-line course was aimed at for the flow of energy from coal to electricity. The whole of the fuel, which is pulverised in a separate building situated alongside the coal store, is pumped through four pipes into the boiler house. The steam flows in the same direction through the turbine house, and, similarly, the electricity to the switch house.

The pulverised fuel is drawn from the mills by means of exhausters, and is pushed into two bunkers by powder worms. All the apparatus carrying the pulverised fuel is under a slight vacuum. The vapour coming out of the dryers carries a certain amount of coal dust, which is removed by means of electric filters. All operations in the fuel house are controlled electrically from a switchboard in the same building.

Sixteen boilers are installed in two boiler houses; they are served by eight chimneys. Each boiler is of the tri-drum semi-vertical tube type, and is complete with an economiser and air heater. The heating surface is 18,837 sq. ft., and the capacity of the whole unit is 65 tons of water per hour. Ten burners serve each boiler. The largest type of drum installed has a diameter of about 5 ft., and is 40 ft. long; it weighs 25.5 tons. The steam drums are suspended from the roof in suitable slings.

The furnace walls are water-cooled, and a grid of water-cooled pipes in the bottom produces a cool zone for granulating the particles of ash. All these systems of cooling pipes are connected in two circuits to the bottom and top boiler

drums. In suitable heaters arranged in the flue combustion air is raised to 150 deg. C. before being taken to the furnace. The fuel is blown vertically downwards into the combustion chamber. The installation includes induced-draught plant which is switched on at half load.

It was decided not to bleed the main turbines, but to obtain the heat required for the feed water from separate feed-heater turbines. There are three of these, one for each main unit, each of 10,000-kW capacity, and running at 3,000 r.p.m. Each of the three main units in the turbine house has a normal capacity of 70,000 kW at 80 per cent. p.f. and 1,500 r.p.m. They will, however, develop a continuous overload of 80,000 kW at 90 per cent. p.f. Each unit has two independent shafts, one with a high-pressure and an intermediate-pressure cylinder, and the other with two low-pressure cylinders over two condensers. The output of each half unit at full load is exactly equal. Regulation takes place only at the inlet of the high-pressure cylinder. The capacity of each of the two generators of each unit is 44,000 kVA, 6,000/6,600 volts. The exciters are directly coupled. An enclosed water-cooled system for cooling the air for the generators is employed. The condenser auxiliaries are electrically driven, but an auxiliary geared turbine is provided and arranged to start up automatically as soon as the motor speed drops to a pre-determined value. The condenser plant is situated in an annexe to the turbine house.

The whole of the plant for the exhaust steam supply, feed-water heating, pumping and the evaporation of the make-up water is housed in an annexe between the two boiler houses. The feed-heater turbines are arranged and connected up electrically to take the place of house turbines, their surplus energy being supplied to the main bus-bars. These machines are controlled according to the steam conditions, and not to the output. Under ordinary operating conditions they exhaust into the first heater of the evaporator, and bleeder steam is supplied for feed-water heating, the evaporator, and for the coal dryers.

Six boiler feed pumps are driven electrically, and two by steam turbines; the latter are geared and looked upon as emergency sets. The unit system is also applied to the evaporation plant, there being three sets, each capable of dealing with 20 tons of make-up water per hour.

The control room at present adjoins the turbine house, but its position will be in the centre when the station reaches its ultimate capacity. The bridge connecting this portion with the switch house carries the cables for the measuring instruments, signalling and operating the switches. The cables connecting the main transformers to the switch house are single-phase, and run in tunnels underneath the road.

The 30,000-volt bus-bars are in three sections, divided by oil switches and reactances. Each section is served by one 70,000-kW and one feed-heater set, and one 16,000-kW turbo-generator in an old power station nearby. The 35 000-kW generators are each connected to a transformer of the same capacity, and the two transformers of one unit are electrically connected in parallel on the 30,000-volt side.

Eight 30,000-volt feeders radiate from each of the main bus-bar sections. Each feeder will carry 15,000 kVA, and is made up of two three-phase cables in parallel. The isolating switches as well as the oil switches are remotely controlled from the control room.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A House-Service Outfit.

A recent introduction of the MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham, is the "Memset," a complete installation outfit comprising a double-pole main switch and a 2-way double-pole fuseboard, self-contained in one small cast-iron case. The rating is 15 A at 250 V. It is claimed that the "Memset," fig. 1, saves the cost of a separate fuseboard, simplifies wiring and erection, and very materially reduces labour and material costs on small

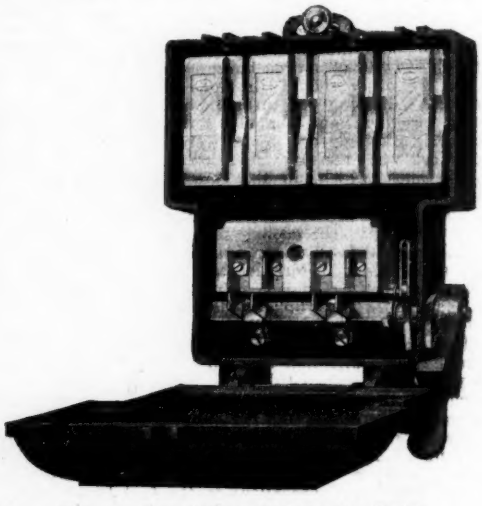


Fig. 1.—The "Memset" Service Outfit.

installation jobs. The switch movement is the same as that in the makers' "Memette" switch. The blades are of hard-drawn copper, directly mounted on a square-section insulated steel shaft, thus ensuring synchronous break on both poles. A standard switch was tested at the Birmingham University electrical laboratory, upon a 250-volt circuit, and was operated about 200 times with loadings of from 15 to 200 A, ten times to each rating. The switch broke 200 amperes at 250 volts satisfactorily, representing an overload of 1,330 per cent., without breakdown. The switch was then tested on higher voltages and broke equally satisfactorily 25 A at 375 volts, and 15 A at 440 V.

A Mining-type Circuit Breaker.

The oil-immersed circuit-breaker shown in fig. 2 is a recent production of the DIAMOND COAL-CUTTER CO., LTD., Stennard Works, Wakefield, and was shown at the last Cardiff Engineering Exhibition. It is a 60-A switch, designed principally for use at gate ends, and is fitted with the standard B.E.S.A. cable plug. It embodies the makers' patented overload device, whereby, it is claimed, the initial rush of current on starting up can be accommodated without tripping, but after the motor has run up to normal speed, the setting of the switch is automatically brought down to allow an overload of approximately 50 per cent. full load before tripping. The

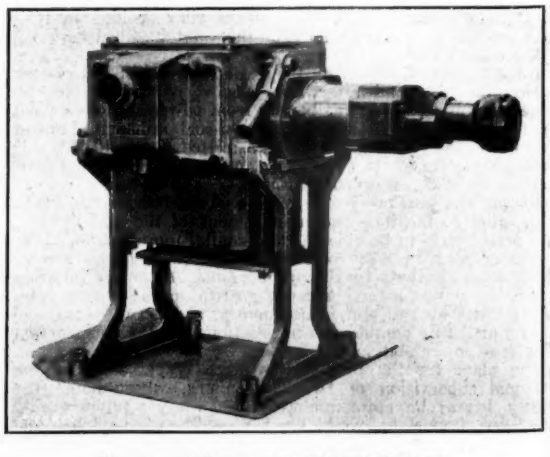


Fig. 2.—"Diamond" Circuit Breaker.

setting of the trip gear is regulated exactly as that of the larger "Diamond" oil-immersed circuit-breakers. The main contacts are of the laminated-brush type, of large section, and designed to give an efficient wipe contact with negligible heating. The arcing tips are of sufficient proportions to effectively break the arc, and are arranged for easy renewal. Hard micanite insulation is used throughout, with the exception of the oil-tank lining, which is of pressphan, the inter-phase shields and plate insulation being of paxolin. A long double-break is fitted on each pole under a large head of oil. The incoming and outgoing ends of the switch are so arranged that different types of fittings can be supplied at either end as

required. The free-handle principle has been adopted as well as flame-proof features. The oil tank is of welded steel, forming a separate chamber from the main frame. Interlocking ensures that the switch must be in the "off" position before the cover, tank or plug can be removed to give access to the current-carrying parts.

A Flameproof Gate-end Switch.

It is becoming increasingly necessary to provide proper means for controlling the supply to portable electrical mining apparatus, such as coal cutters, conveyors, and so on, and in this connection fig. 3 shows a three-pole flameproof switch and fuse with plug which is manufactured by Messrs. ERSKINE HEAP & CO., LTD., Caroline Street, Broughton, Manchester, and which, it is claimed, can be used in any conceivable position. The apparatus being flameproof, the break is not arranged under oil, and heavy or short-circuit currents are taken care of by the "cool handle" fuses with which the apparatus is fitted. The fuses result in an automatic time lag, which is so essential for the fluctuating loads met with on coal cutter or conveyor work. The switch mechanism is so

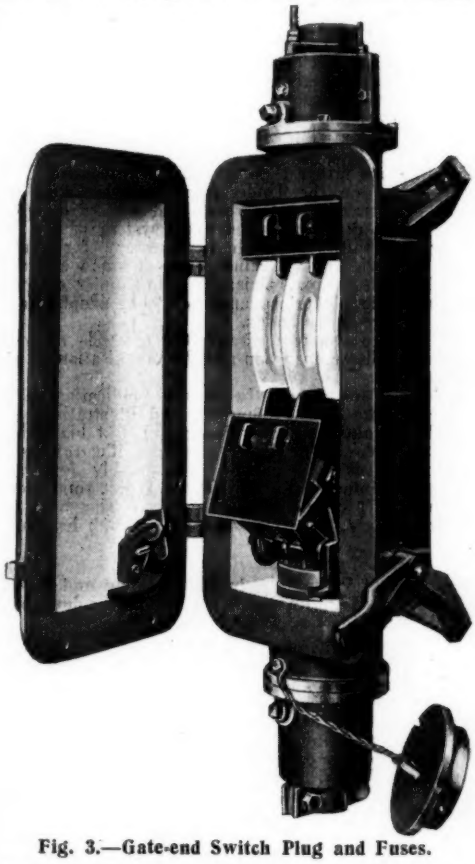


Fig. 3.—Gate-end Switch Plug and Fuses.

interlocked that the plug cannot be withdrawn until the switch is in the "off" position, after which the lid can be opened for examination of the fuses, &c., but the switch cannot again be closed until the hinged flameproof lid has been reclosed and the plug is again in position. Both the switch and fuse contacts are fitted with the makers' patent reinforcement, which makes it impossible for the jaws to be bent out of shape and, in the event of the jaws becoming softened, gives the necessary pressure to enable them to make perfect electrical contact under all conditions. The makers have just completed a large contract for these switch units for use in South Africa. The apparatus is designed to carry three-phase current up to 100 A at pressures up to 660 V. It complies fully, it is claimed, with the Mining Regulations, and is provided with means for earthing.

"Phylaxite"—a New Varnish.

In our issue of December 9th last we published some particulars relating to "Phylaxite," the new varnish of PHYLAXITE PRODUCTS, LTD., 37, Walbrook, E.C. We have since seen the reports on some tests carried out by the National Physical Laboratory relating to the properties of the varnish. In one test 12 pieces of steel gauge plate were used. Two of these were unprotected, eight were given one coat of the preservative and two were given two coats. They were all hung upon a frame on the roof of the laboratory and exposed to the sun, wind, and rain for three months. The plates were weighed before and after coating with the varnish, and again after exposure. The plates covered with two coats lost a trifle, showing that the loss in weight of the protecting material more than counterbalanced any oxidation of the plates. The plates with a single coating gained an average of 0.01 gram per plate, as against an average of 0.655 gram per plate gained by the unprotected plates. One of the single-coating plates showed neither loss nor gain. It is clear, therefore, that the Phylaxite greatly decreased the oxidation of the metal. In another test samples of Bristol board were coated with the varnish, and, after being dried, were immersed in water for varying periods of time. The average percentage absorptions after periods of 5 min., 2, 7 and 24 hours, were 0.2, 2.4, 7.8 and 16.5 respectively. In another test circular glass funnels were cemented on to pieces of Bristol board and the funnels then filled with water to a mark on the stem. Measured quantities of water were added from time to time to keep up the level to the original head; this added water consisted of the sum of the absorption and percolation. During 23 hr. 5 min. the added water to a funnel with an uncoated piece of board was 0.31 grams per sq. cm., while the mean added water to funnels with coated boards was 0.028. The water added during 192 hr. to the funnels with coated boards was 0.262, mean.

It is interesting to learn that the curator of the Imperial War Museum, as a result of being strongly advised to use "Phylaxite" for protecting armoury exhibits, carried out tests on the preservative at the Museum which have proved very satisfactory.

Two Runbaken Products.

A recent production of the RUNBAKEN MAGNETO CO., Tipping Street, Ardwick, Manchester, is the "Quixo" magneto key, by means of which, it is claimed, any operations in connection with the well-known makes of magnetos, Simms, M.-L., B.T.-H., and so on, can be effected. It is a compact little outfit, and embodies a key for the contact screw nut, a contact gauge, a reamer, a screw driver, a spanner for adjusting the contact screw, and a contact breaker centre screw.

Another introduction of this firm is a magneto contact breaker key gauge, which should prove useful to anyone concerned with the repair of adjustment of magnetos, it being the practice nowadays for firms to leave their spare contact breakers blank. The gauge shows the key position for practically every standard magneto, one side giving the left-hand positions and the other the right.

Reviews.

Alternating Current Electrical Engineering. By PHILIP KEMP, M.Sc., M.I.E.E. Pp. xi+575; figs. 423. London: Macmillan & Co., Ltd. Price 15s. net.

The volume under notice is the third edition of the book which was first issued in 1918 and is already well known to those interested in the education of electrical engineers. Additions have been made to the contents of the book in regard to both the practical and theoretical sides, and in the latter connection it is interesting to find a short chapter devoted to symbolic notation. In his preface to the first edition, the author made a plea for a higher standard of mathematical attainment than was at that time usual amongst students of electrical engineering, and it is to be hoped that the presence of this new chapter indicates that progress is being achieved in the desired direction.

The sooner that it is generally realised that the policy of attempting the study of alternating currents without adequate mathematical equipment is really wasteful, the better it will be for all concerned, since restriction to elementary mathematics leads to lengthy, and often unsatisfactory, demonstrations of various important theorems which can be dealt with much more expeditiously if the necessary mathematical knowledge is available. The method of symbolic notation is not known to the majority of electrical engineers, though it materially simplifies the solution of certain types of problems dealing with networks of impedances.

The greater part of the book is concerned with the study of the properties of alternating currents and with accounts of the various types of electro-magnetic machines suitable for operation on alternating current circuits. There are, however, chapters dealing with certain other phases of alternating current engineering such as rectifiers, transmission of power, and protective systems. The introduction, in the present edition, of a series of numerical examples with answers also adds to the utility of the work.

The book is carefully and accurately written and may be recommended to those desiring to improve their knowledge of alternating current phenomena and, in particular, to students reading for an engineering degree or Higher National Certificate.

The Propagation of Electric Currents. By J. A. FLEMING, M.A., D.Sc. 4th Edition. Pp. xv+422; figs. 25. London: Constable & Co., Ltd. Price 21s. net.

The appearance of a fourth edition of Prof. Fleming's textbook is in itself adequate evidence that he has succeeded in providing a clear account of the transmission of electrical signals along wires. The mathematical introduction and the formal electromagnetic analysis of the earlier chapters have naturally a special appeal to the student, and those parts dealing with the constants and performance of cables are more for the practising engineer, but the book can be read throughout with profit by either.

We are particularly concerned here with Chapter X. This

is new, and comprises a number of important references to the latest advances in the construction of telephone and telegraph conductors. The first section is a short account of the eddy-free "dust-core" which has been evolved by the Western Electric Co., U.S.A., and we note that Prof. Fleming has given all essential data both for the material and for a typical loading coil in which it has been employed. This is followed by a discussion of how existing lines can be employed best to cope with the rapidly increasing demands made upon them, illustrated with the methods which have been adopted for the London-Birmingham-Liverpool underground cable. The uniformly loaded submarine cable between Key West and Havana is then described, and the fact that its constants fail to satisfy Heaviside's criterion for absence of distortion serves to introduce the subject of "Permalloy." There is a concise summary of the preparation and properties of this invaluable substance, which, from its space lattice, appears to be essentially a *nickel*: some other alloys which have been tested are also mentioned. In the next two sections a more detailed account is given of the loaded telegraph cable, and of how the introduction of material of high initial permeability can increase the potential speed of signalling. Prof. Fleming's opinion (p. 379) is that, in spite of difficulties in duplexing, ". . . the discovery of the remarkable properties of 'Permalloy' has rendered antiquated all pre-existing types of cable. . ."

Apart from short notes on the measurement of attenuation constants and of impedance, the remainder of the chapter is devoted to the application of thermionic valves. The theory of their use for relay purposes is given in some detail, and a formula is developed for the number of miles of standard cable equivalent to a repeater. There is also a plate showing part of the relay station on the London-Glasgow line at Derby. The subsequent account of carrier-wave telephony, although necessarily somewhat condensed, is good, and includes all that is required by anyone who is not a specialist.

The greater part of Prof. Fleming's book will probably remain a standard treatise on the subject for many years, and the generous acknowledgments made in the preface in no way detract from the service which he has performed in bringing together in an accessible form so much difficult and scattered material. The concluding chapter will probably require considerable amplification later, but for the present it has abundantly justified its insertion as an outline of the most important recent practical work.

Modern Ignition Simply Explained. By HAROLD H. U. CROSS. Pp. 144; figs. 58. London: Crosby, Lockwood and Son. Price 4s. net.

In a recent issue we reviewed Mr. Cross's somewhat extensive work on "Electric Lighting, Starting and Ignition for Motor Cars." The author has now produced a smaller book as one of the series of Lockwood's manuals, in which he deals in a simple manner with the underlying principles of the various forms of electric ignition which have been, and are to-day being, used on motor vehicles. Being intended for the use of novices in electrical details, the first few chapters are devoted to matters with which electrical engineers are already familiar, although Mr. Cross's hydraulic analogy of water pressure and flow, with the voltage and amperage of electrical circuits, is both novel and effective, albeit that some of the diagrams have apparently more to do with electric lighting, notably figs. 1 to 6, than with ignition.

Although the author would seem to have a leaning towards the modern battery-cum-dynamo form of ignition as adopted on many American cars, he devotes considerable space to the high-tension magneto, which is still very widely used. One chapter is devoted to the timing of magnetos, a matter which is perhaps better left to the expert than tampered with by novices, although the latter will find many useful suggestions and hints well within their scope in the chapters devoted to what Mr. Cross terms "Plug-ology" and Care and Maintenance.

The book runs to just over 140 pages and is well illustrated, a fairly complete index being included. Here and there Mr. Cross gives vent to his customary facetiousness, which we always regard as out of place and irrelevant in technical writing. Moreover, here and there he slips into such American terms as "spark-plug" and "automobile," for which we would, in an English publication, prefer the English equivalents. Again, we are accustomed to hearing the magneto referred to as the "mag.," but "maggie" is quite new to us. The name Scintilla is wrongly spelt on page 99, although correctly given on another page.

Moreover, it is now nearer thirteen rather than just "over ten years" since Britain imported 98 per cent. of the magnetos used on British cars and lorries, the reduction of imports of foreign magnetos dating, of course, from the outbreak of the war.

British Railway Operation. By T. BERNARD HARE, A.M.Inst.T., with foreword by SIR RALPH L. WEDGWOOD, C.B., C.M.G. Pp. 156. London: Modern Transport Publishing Co., Ltd. Price 3s. 6d. net.

This book is based upon a series of articles which the author (who is on the staff of the London and North-Eastern Railway, and is lecturer on transport subjects at Leeds College of Commerce) contributed to *Modern Transport*. Its aim is to provide a general outline of the commercial side of railway operation. The author can be congratulated upon having achieved his object, as the book contains much information which will be of use both to the student of railway engineering and to the general operating staff of our railways.

The book contains chapters on Signalling, Terminals (passenger and goods stations), Marshalling Yards, Rolling Stock, Passenger Services, Freight Services, Working of Shipment, Mineral Traffic, Train and Traffic Controls, Electrification, the Underground Railways, Statistics of Operation, and Organisation.

The general subjects are discussed in detail, and a considerable amount of information is compressed into 142 pages. The treatment is on broad lines, being critical and non-discursive. Alternative methods of working are considered and their advantages and disadvantages are discussed impartially and critically in the light of the experience which the author has gained during twenty years of railway service.

The chapters which are of special interest to electrical engineers are those dealing with electrification in general and the Underground railways. In the former the author gives a concise statement of the relative advantages and disadvantages of steam and electric railway operation. He observes that the electrification of British lines has hardly developed sufficiently for us to appreciate fully the advantages to be obtained by its application to main-line working. He recognises that electrification would postpone expensive widenings and would give a quicker service both for passenger and freight traffic, together with mutual benefits to industry and the railway company due to the cheapening of power production. He attributes the present difficulties of electrification to the exceptionally stringent financial position of British railways rather than to lack of enterprise.

The chapter on the Underground railways first gives a general comparison of underground and surface railways, and then discusses the special operating system of the London Underground railways which is necessary for running a maximum service of 40 trains per hour on a single track. The author shows how efficient working under exigencies of rush-hour traffic is obtained and the means adopted to ensure the punctuality of the trains.

The last two chapters discuss the methods of compiling statistics of railway operation and the organisation of the railway staff.

With a view to reducing the costs of publication the author has avoided the use of diagrams and illustrations (in fact the book contains only one line block), but his lucid treatment is so noteworthy that the lack of illustrations cannot be considered as a detriment. Presumably for the same reason the printers have utilised the typesetting and width of column (2¼") of the original articles. The wide margins have, accordingly, been utilised for paragraph headings.

Inventions and Patents, their Development and Promotion. By MILTON WRIGHT, LL.B. Pp. 225. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d.

About 85 per cent. of the industrial wealth of the United States is based directly or indirectly on patent rights. The annual output of all the gold, silver, and diamond mines in the world does not equal in value the yearly profits derived from that country's inventions. Unfortunately, too many inventors—in the United States and elsewhere—lose, by want of knowledge or by carelessness, the financial results of their genius or assiduity. The value of patents depends largely not only on the skilful preparation of the specification and claims, but also on the knowledge of when to do certain things and how to guard against what may prevent patents being granted or, if granted, make them useless.

This interesting book gives valuable information on all these points, and shows the very many pitfalls awaiting anyone not fully acquainted with the subject who attempts to take out a patent in the United States, and the absolute necessity of his employing a good patent agent, or—as it is called in that country—a patent attorney. (An inventor here will employ a patent agent here, who will have his collaborator on the other side.) It is not every patent attorney who is satisfactory, and there are a considerable number of men in the United States not patent attorneys and not entitled to represent inventors in connection with applications for patents, who delude the unwary in order to get money out of them, and who give them nothing in return. Patent attorneys—however honourable and competent—should not be left by the inventor to do all the thinking, since inventors, after getting to know a little about patent law and practice, may make valuable suggestions. Much of this is explained in Chapter III, which gives specimens of the circular letters sent out by the unqualified people referred to.

One of the great differences between the patent law of Britain and that of the United States is that in the United States a patent can be granted to an inventor whose invention has been in public use or on sale in that country for not more than two years prior to the date of his application for the patent. In Britain the invention must be unpublished, and not made use of in the ordinary way of business (unless secretly and for the purpose of testing), prior to the date of the application, and the person who first makes application has the priority—unless he stole the invention from some other person, and this can be proved. (Such priority may be modified by certain rules under the International Patent Convention.) In the United States there may be many applica-

tions for a patent for the same invention, and there may be great difficulty in deciding who is the original inventor. Some of these applications may have been lodged after the original inventor made his invention public, and after the applicants have seen it in use, and the original inventor may be by no means the first applicant. In circumstances of this kind each party to the "Interference"—as it is called—has to file at the Patent Office a statement made under oath giving, among other things, the date when the invention was originally conceived, when the first drawing and written description were made, and when the invention was first disclosed to others. Notes, documents, and drawings can be produced to support such statements. It is clear that, in these circumstances, there are many opportunities for fraud. The safest plan is to make the application as soon as possible, and before the invention is disclosed, since the first applicant is in the best position—the burden of proof being on each of the others to show that he is the original inventor. In Chapter V inventors are told how to preserve evidence of their being the original inventors, but more emphasis might have been laid on the desirability of making the application before the invention is disclosed. The rules given for preserving evidence are apt to be forgotten, since the wisest of people speak and act thoughtlessly at some time or other. Even if these rules are all remembered and followed the patent may be lost, or may be won at great cost, since it is the man who puts in his application first who has the legal presumption in his favour. Under the British system all that an inventor needs to know is that he must keep everything secret—with the exception of what he may tell confidentially to friends or others—until he has obtained provisional protection, after which he will be safe, unless the invention has been invented and protected or published by some other person prior to the date of his application.

It is clear from what has been said that inventors in this country should not trust too much to the International Patent Convention when considering the matter of applying for patents in the United States.

A chapter entitled "Patents Pending" gives details of the process of getting a patent in the United States, and gives reasons why, in certain circumstances, inventors should endeavour to get the grant of their patents delayed. Chapter VIII—"Traps Set for Patentees"—mentions various devices by means of which fraudulent persons endeavour to get money out of inventors. What is described here is not quite unknown in Britain. Other chapters tell how to find out what the patent is worth, how to find a buyer, when to sell outright and when to take royalties, and how to raise capital, and are full of valuable advice which is applicable to other countries besides the United States. There is a chapter on trade marks.

Electric Circuit Theory and the Operational Calculus. By J. R. CARSON. Pp. 193; 32 illustrations. London: McGraw-Hill Publishing Co., Ltd. Price 15s. net.

This is the first edition of a work which deals, first, with an exposition of the Heaviside Operational Calculus, and, secondly, with the application of this system to advanced problems of the theory of electric circuits. The work is of a highly mathematical nature, as may be judged from the title, and it should prove of considerable assistance to the physicist and to the specialist investigator of electrical theory. The first five chapters are concerned solely with an exposition of the Heaviside Operational Calculus and give various equations, formulæ, and theorems relating to the system. The next four chapters treat of the propagation of current and voltage in various types of circuits, while the remaining two chapters consist of an introduction to the theory of variable circuits and the application of the Fourier integral to electric circuit theory, respectively. A bibliography of papers published elsewhere which deal with the subject matter of the volume is included. The volume is an excellent representative of its kind, and we have no doubt that sooner or later a copy will find its way to the book-shelves of all serious mathematical investigators of electrical theory.

Business Forecasting and Its Practical Application. By WILLIAM WALLACE, B.Com.(Lond.), with an introduction by Mr. W. T. LAYTON, C.H. Pp. xiv+117; 12 diagrams. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

A business man able to foretell the trend of his business with the greatest confidence, to forecast the volume of his sales, or the rise and fall in prices, would appear to have attained one of his highest ambitions. Yet, in this book, Mr. Wallace sets out to give him more than an inkling of how to possess himself of that faculty which will lead to sound business forecasting! It seems to be no mere fantastical theory that is submitted, for throughout the book there is that backing of personal experience that is worth a world of vain imaginings.

To have had prevision of the slump of 1920-21 would have saved many millions of pounds for British manufacturers and wholesalers. It would have meant many million less days of unemployment to the workers. Surely, then, with the means of foretelling any future disturbance, whether depressions or booms, within the reach of every business man, there must be great hopes of averting the repetition of such a trade debacle as we have witnessed in the last few years. It seems impossible that our leaders of industry and commerce will defer a complete study of so promising an aid to profitable enterprise.

Not that Mr. Wallace lays claim to presenting a sure remedy for our troubles. He is a pioneer, only too well aware of the shortcomings of what Mr. Layton terms in his introduction a "nascent science," but he does present a case calculated to convince the perceiving man of the immense possibilities of his subject. He clearly states that this is no substitute for judgment, a gift that has descended upon generations of British business men and which has been no mean factor in establishing the supremacy of Britain in the markets of the world. It is, rather, an aid or a support for that inheritance. Nor is forecasting a craze which every up-to-date business man may pursue, as is more or less the case in America.

In many respects our American cousins have been quite useful to us. They allow their enthusiasm to run riot in many spheres, permitting us to sit back and view their wanderings, so that, eventually, we are able to pick out just those parts and applications of their new found interests that can be adapted to our service. It is thus with business forecasting, and the author sifts out for us the grains of gold from their delvings, smelted and moulded into an instrument fit for British use.

It is the first book of its kind to be published in England. It will not be the last. It is hoped that Mr. Wallace will be so encouraged by the results of this, his first effort, that he will give further light on a subject of paramount importance.

There is a certain piquancy in the author's writings that makes his facts and deductions easily assimilible. Would that every writer on technical subjects had a similar gift of presenting his matter in so palatable a form. In ten chapters he travels from a statement of the problem, through its theory, and some very simple applications, to a description of the methods and uses of forecasting sales, prices and investments. Two useful appendices give the Sources of Information and a very sound contribution on the presentation of graphic charts. The former stretch from the daily papers to Census returns and the Economic Services. The series of diagrams are clearly marked, thoroughly germane to the text.

The days of "rule of thumb" methods are waning, though not without a severe struggle on the part of a certain section of the business community; that section which, through want of foresight and knowledge of passing events, is, unwittingly perhaps, but none the less seriously, putting a sprag in the already slow revolving wheel of prosperity. Nowadays a man must not expect just to produce and sell without applying scientific method to *every* part of his organisation. Scientific management, of which we heard so much a short time ago, is but a generic term. Each of its branches is gradually becoming a separated entity. Success in business can only be obtained by full use of every branch. Only a little while is it since scientific methods of costing were rare, and since scientific salesmanship and advertising were almost unknown. Advance in these realms has meant much to the manufacturer and distributor, and as surely as has been this advance, so surely will be the progress of this newer, but not less important, science.

Those who read Mr. Wallace's book will wish to thank him for opening up a vista of one of the avenues that must lead to more prosperous days for industry and commerce.

Hydro-Electric Handbook. By W. P. GREAGER and J. D. JUSTIN. Pp. xxiv+897; figs. 494. London: Chapman & Hall, Ltd. Price 40s. net.

This book has been written by Mr. William P. Greager and Mr. Joel D. Justin, with the assistance of nine contributors, some of them being well known in the engineering profession. The book presents a compendium of the different phases of modern hydro-electric practice. Of the 881 pages of text, 658 treat of the hydraulic part of hydro-electric development. Rainfall, evaporation, factors affecting runoff, estimating stream flow, flood flows, capacity of the development, output capacity and flow demand, storage and power available, hydraulics, general design, earth, timber, masonry, and rock-fire dams, head-water control, conduit intakes, conduits and canals, pipes and pipe line, surge tanks, power house substructure and superstructures, and hydraulic turbines are all treated of in a clear and able manner. There are 143 pages devoted to the electrical part of the hydro-electric development, which in a similar manner touches on the electrical design, generators, exciters, transformers, switching equipment, station wiring, auxiliary power and lighting of station, and the transmission line. The remaining part of the book deals with investigations and reports, river gauging, and the operation of hydro-electric properties. The authors endeavour to cover all the important branches of the subject, and the book presents information that is of value to the student and practical engineer. The book is well written, printed and bound, and is well worthy of praise. There are several worthy features about the book, and it is free from padding. It should be in the hands of all who have to deal with hydro-electric properties or are studying the subject.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Cost of Electricity at Exhibitions.

May I draw your attention to the excessively high charges made for electric power used by exhibitors at Olympia?

I have before me a prospectus of an exhibition to be held there shortly, wherein the price for heating and power on alternating current is given as 4d. per unit, and that for power on direct current as 8d. It is not surprising that many exhibitors refrain from showing their machinery, &c., in operation. This not only causes great disappointment to visitors, many of whom come from abroad, but also often results in loss of business through lack of demonstration facilities.

These charges become even more surprising when one remembers that the supply at Olympia is taken from the Borough of Hammersmith—one of the cheapest of London's supply authorities.

Further, any exhibitor requiring more than about 5 or 10 kilowatts has to run cables from the nearest switchroom to his stand, which may be 50 yards or more away. This extra expense on top of the exorbitant charges for energy must deter many firms, both large and small, from showing their products in operation, if not from exhibiting at all.

Industrial.

London, *December 28th*, 1927.

[We refer to this matter in our leading columns to-day.—EDS. ELEC. REV.]

Accumulative Anode Detection.

It would appear from Mr. J. Jansen's recent criticism, in these columns, of the above form of "detection," that the idea of rectification which is not dependent on a "bend" in one or other of the characteristics, or on the unilateral conductivity of a valve, is not understood and is criticised without serious consideration.

I agree with Mr. Jansen that the function of the first valve is purely that of a variable resistance, and, in fact, if a resistance of sufficiently rapid variability were inserted in place of the first valve the unbalance effect would be noticeable just the same. Mr. Jansen suggests that this arrangement consists only of resistances following "Ohm's Law." He has evidently overlooked the fundamental presence of capacity, either between valve electrodes or added, not to mention my express reference to a "time-constant," and although no doubt such a condition would not be met by "Ohm's Law" in its simple form, especially as it is not direct current of constant amplitude with which we are dealing, like most other laws, "Ohm's Law" is capable of expansion to meet the exigencies of modern thought and conditions.

May I suggest that Mr. Jansen re-reads my article thoroughly, and perhaps he may even be persuaded to try the conditions for himself, when I feel sure that he, like many others who have been no less sceptical than himself, will agree that there is no real mystery about this form of "detection," and that it only obeys laws equally as fundamental as "Ohm's Law."

Just one point: Mr. Jansen appears to think that since there is no absolutely "straight" portion on any valve characteristic, "anode bend" rectification may be taking place. Apart from the fact that in any case only extremely inefficient rectification would result, it is not the presence of a "bend" in the characteristic which results in detection, but the fact that normally a "bend" has the effect of causing the change in anode current to be greater on one side of the polarising (or bias) potential than on the other, though this is by no means the case when passing the "bias" point through the centre or balance part of the characteristic.

Ernest W. Braendle.

Blackheath, *December 28th*, 1927.

Protection Systems in Coal Mines.

I was interested in the article on the above subject published in your journal of December 23rd. I agree with the author in his recommendation of a method or system of protection that will afford the greatest measure of safety without complication or faddism.

Whilst past legislation has added to production costs, it is essential that such regulations should exist. The results of investigations of accidents, faults, &c., by Home Office officials are very much appreciated and are of the greatest value to maintenance engineers. I have looked upon the mine and factory inspectors as "helpful friends" and not as "detectives"; the interchange of views tends to create safety, reliability, and lower maintenance costs.

Mr. Austin has referred to papers written by Messrs. Wedmore, Clothier, and others on the subject of protective gear. I consider that with the various systems on the market it is possible for every installation to be fitted in a manner that not only complies with the regulations but will give increased efficiency to the electrical installation.

I presume that "Overhead protection" (column 1, page 1076, last paragraph) is an error and should read *overload* protection, and I concur with the author in its importance when applied at the coal face.

It may be of interest if I refer to the fact that I have been connected with a large colliery installation for the past 14 years where extensive use is made of electricity underground for coal cutters, conveyors, haulage gears, &c. Electrical energy in some instances is delivered inbye (2,000 yards) at 3,000 volts, and stepped down to 600 volts for medium-pressure supply; in other cases l.p. supply is delivered from the pit head. In all cases of transformation the neutral point is earthed direct (in the case of inbye transformers, the conductivity of armouring of the h.p. supply cable is 50 per cent. of the conductivity of the l.p. feeder).

Balance leakage protective gear is installed on the l.p. feeder or feeders at the respective sub-stations; the installation of such protective gear has been justified in every possible way, no trouble having been experienced with c.t.s or relays, and the maintenance costs have been negligible, during 12 years' service.

In all cases of gate-end switches, numbering about 70, the switch-fuse type of Diamond make has been used successfully; I cannot recall any case of a "roast out."

With the author's remarks regarding the ability of switchgear to clear a dead short circuit without damage I agree, but I would say that I have not found a switch made by reputable makers fail to comply with such condition. I consider it very important in connection with switchgear and transformers that the oil should be tested for dielectric strength periodically and not left until trouble arises.

From the remarks I have made the author will see that I have conformed with two items of his mature considerations. With regard to pumps and large haulages being supplied by separate feeders, this requires a very great deal of consideration of the layout, character, position, &c.

I have known several cases where pumps and ventilating fans at pit head and pit bottom were fed separately, but there are collieries which have large haulage gears 1½ miles inbye; further, if the output of the haulage is dependent on inbye coal-cutters, &c., it is no disadvantage for the supply to be "off."

I agree that safety warrants the best possible job being put in: I consider that this fact has been appreciated by colliery owners during the last few years.

With regard to the author's last remarks, I leave these to the compressed-air engineer to air his views.

C. Jones.

Walsall, *December 26th*, 1927.

Overhead Line Regulations.

I have to-day seen Mr. J. A. Morton's letter in your issue of December 23rd, in which he "makes hay" of my proposal to substitute double suspension for Trotter guards for low-pressure conductors along and near highways.

My proposals were put forward after due consideration, and as a result of considerable operating experience.

Based upon the fact that a fallen low-pressure conductor (say 250 V, a.c.) is dangerous because it will not disconnect the circuit by leakage current, whereas a 10,000-V conductor will operate the circuit-breaker on reaching earth, I consider that earthing guards will not be given up by the Commissioners unless we offer some approach to certainty that conductors will not fall in frequented places.

In exchange for the cost of a few low-pressure insulators and bridles on a portion of our line we would secure the removal of Trotter guards for the whole line, and with it a removal of the danger to linesmen and of the frequent failures due to earthing guards. Moreover, we would have, according to my proposals, equal factors of safety and pole height as between high- and low-pressure lines, so that one could convert from low to high pressure by merely changing insulators.

The new principle I put forward was that the grading of pole heights and precautions should be based upon location, in relation to public liability, rather than upon artificial pressure limits. Thus a fallen 250-V line on a highway is much more dangerous than a fallen 20,000-V line in a field or on a moor.

With regard to appearance, while I prefer that of double suspension to any earth guard, it would not affect my view if Trotter guards were positively handsome! All earth guards are dangerous to continuity of supply if near enough to the live wire to be effective, and we must offer decreased risk of wires falling in public places if we are to secure their abolition.

W. Fennell.

Northwich, *December 31st*, 1927.

Pulverisers or Stokers?

The relative merits of pulverised fuel and stoker firing have again been brought forward by Mr. Pausey's article in your recent issues. In the first place, I cannot agree with Mr. Pausey that chain-grate stokers can burn, with the same efficiency and boiler output, coals varying in ash content from 5 to 25 per cent., and moisture of a similar figure with only operating adjustments. Coal having an ash content of 20-25 per cent. can be burnt, and was burnt during the coal strike, but the efficiency suffered enormously. With chain-grates dealing with very fine or mixed slacks, there is always the difficulty of keeping an even fire, handling riddlings, and

preventing combustibles in ash. The difficulty of feeding mixed coal is well known, and if the ash content reaches a high figure the steaming rate is seriously effected and difficulty is experienced in discharging the ash. The amount of unburnt carbon in ash is in the neighbourhood of 10-25 per cent. with mechanical stokers. Tests taken by the writer on a number of samples of ash obtained from pulverised-fuel furnaces showed this to range between 1 and 4 per cent. Loss by radiation must also be reduced by the use of air- and water-cooled walls, besides adding, in the case of water-cooled walls, an additional heating surface to the boiler capable of taking advantage of radiant heat absorption. Taking two plants with equal sized furnaces and heating surfaces, and working under a given load, one with pulverised fuel and the other stoker-fired, I do not think the efficiency on *test* would be very much in favour of either system, but efficiencies taken over a longer period would certainly show powdered fuel to advantage. Special powdered-coal weighers are now being made and can be placed in the circuit between the pulveriser or screen conveyor and boiler bunker, so that the difficulty of weighing the powdered fuel mentioned by Mr. Pausey is overcome.

With regard to drying, it is certainly not advisable to heat the coal to 220 deg. F. in the dryer; an average should be about 120-150 deg. when leaving the dryer, and this, of course, can be regulated to suit the conditions. I think the only way to determine whether powdered fuel is justified or not is to take each plant on its own merits, due consideration being given to capital cost, size of plant, and cost of coal. Each plant has its own problems, and cases may occur where, due to price of coal, size or plant, &c., it is not wise to install pulverised fuel. By having tenders prepared for either system, giving prices and efficiency of each part of the plant, it is easy to see whether any increased capital expenditure is justified.

One of the greatest objections to powdered fuel is the size of combustion chambers; this has been overcome to a very large extent by the turbulent flow method of combustion. A new burner is stated to have been developed on this system capable of completing combustion within 10 ft., which will deal with coal up to 6 tons per hour. This will reduce the size of combustion chambers by half, and also the number of feeders and burners from 10 to 3 or 4 on a large unit.

Figures relating to pulverised fuel maintenance costs have so far not been issued by any English power station except Derby, and I would draw Mr. Pausey's attention to the address given by Mr. G. H. Lake to the East Midlands Sub-Centre of the I.E.E. Mr. Lake gives particulars of his boiler maintenance costs for 14 months, and the cost of renewals, including brickwork, labour, &c., equals 8.02d. per ton. I think this speaks well for pulverised fuel. Stoker and brick-work maintenance, even in a large station, generally runs to 1s. or 1s. 4d. per ton. Mr. Lake also states that his plant at Derby has been a complete success. It is to be hoped that Barking, Birmingham, &c., will at a later date allow such interesting figures to be published.

Bury, *December 27th*, 1927. **Vernon Walker.**

Wanted, a Relay.

Could any reader tell me where I could obtain a relay to "make" a local circuit whenever the current in the main circuit falls below a certain value? It is required to be accurate to about 5 per cent., so that, if the relay is arranged to carry, normally, a d.c. of 6 amperes, the local circuit will make every time the current falls to 5.7 amperes, and after having "made" the circuit, it will then break the circuit if the current is restored to normal.

London, *December 29th*, 1927. **P. E. K. Hole.**

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1926.

14,182. "Caps for multi-filament electric lamps and similar apparatus." G. Hermont and G. Gunzburg. June 4th, 1926. (Convention date not granted.) (253,138.)

16,940. "Thermionic valve circuits." Gramophone Co., Ltd. (Victor Talking Machine Co.). July 6th, 1926. (281,740.)

17,438. "Electricity meters." S. Z. de Ferranti and Ferranti, Ltd. July 12th, 1926. (281,743.)

18,986. "Electric cooking stoves." C. G. Armstrong. August 3rd, 1925. (256,256.)

22,031. "Electrical condensers." J. J. Rowe. September 7th, 1926. (281,758.)

22,062. "Wireless receiving apparatus." W. M. Rolph. September 7th, 1926. (281,759.)

22,142. "Aerials for use in wireless telegraphy and telephony." C. S. Franklin. September 8th, 1926. (281,762.)

22,152. "Apparatus for operating and controlling the doors of tramway or like vehicles." G. D. Peters & Co., Ltd., H. R. Hockley, and H. B. White. September 8th, 1926. (281,765.)

22,196. "Electric secondary batteries or accumulators." H. F. Joel, Sen. September 9th, 1926. (281,770.)

22,266. "Means for preventing pulsation in electric motors." Siemens-Schuckertwerke Ges. September 10th, 1925. (258,273.)

22,348. "Electric control devices." British Thomson-Houston Co., Ltd., and H. W. C. Liddiard. September 10th, 1926. (281,774.)

22,363. "Wireless or like amplifying instruments." W. J. Brown and Metropolitan-Vickers Electrical Co., Ltd. September 10th, 1926. (281,776.)

22,377. "Electric time switches." E. C. R. Marks (Tork Co., Inc.). September 10th, 1926. (281,778.)

22,459. "Automatic telephone systems." Siemens Bros. & Co., Ltd., W. H. Grinstead, and T. Lyden. September 11th, 1926. (281,779.)

22,578. "Wireless receivers." A. E. Pitcher. September 13th, 1926. (281,784.)

23,013. "Method of improving the tone quality in talking films." H. J. Kuchenmeister. September 22nd, 1925. (258,864.)

23,078. "Loud-speaker trumpet." C. A. Paterson. September 18th, 1926. (281,792.)

23,450. "Speaking-tube attachments for telephones and like instruments." D. S. S. Steuart. June 14th, 1926. (Divided application on 274,525.) (281,801.)

24,277. "Connectors for electrical apparatus such as electric irons, radiators, kettles, and the like." T. W. Fairlie. March 22nd, 1927. (281,809.)

24,353. "Electrical oscillation generators." H. L. Kirke. October 1st, 1926. (281,810.)

25,046. "Control of electrically-driven winding engines, hoists, and the like." English Electric Co., Ltd., and J. D. Dixon. October 8th, 1926. (281,814.)

25,729. "Imitation fires." Automatic Telephone Manufacturing Co., Ltd., and C. H. Archer. October 15th, 1926. (281,822.)

27,699. "Internal electric lamp fitting for automobiles, carriages, and the like." A. Black. November 4th, 1926. (281,839.)

28,040. "Electric starting mechanism for internal-combustion engines." British Thomson-Houston Co., Ltd., and A. G. Salisbury. November 8th, 1926. (281,843.)

28,595. "Means for controlling two-speed polyphase motors for lifts." Smith, Major & Stevens, Ltd., and P. H. Stevens. November 13th, 1926. (281,851.)

29,121. "Magnetic chucks." H. Humphreys. November 18th, 1926. (281,858.)

29,272. "Commutators for dynamo-electric machines and methods of manufacturing the same." British Thomson-Houston Co., Ltd., and A. G. Henton. November 19th, 1926. (281,860.)

29,467. "Systems of electric motor control." British Thomson-Houston Co., Ltd. November 21st, 1925. (261,790.)

29,613. "Protective appliances for high-tension transformers." E. Haefely and Cie. Akt.-Ges. August 30th, 1926. (276,614.)

30,292. "Starting of motor convertors." English Electric Co., Ltd., and G. Schroeder. November 30th, 1926. (281,863.)

30,296. "Coupling devices for electric conductors." J. M. Ortega. November 30th, 1926. (281,864.)

30,639. "Loud-speaking telephonic receivers." W. J. Rickets and L. H. Paddle. December 3rd, 1926. (281,866.)

30,975. "Electrode holders for electric furnaces." Norske Aktieselskab für Elektrokemisk Industri. December 7th, 1925. (262,481.)

1927.

436. "Girder masts." Soc. Française Radio Electrique. January 27th, 1926. (265,165.)

1,302. "Electrical control systems." Metropolitan-Vickers Electrical Co., Ltd. January 16th, 1926. (264,532.)

2,183. "Loud-speaking telephones." Soc. des Etablissements Gaumont. May 22nd, 1926. (Patent of addition not granted.) (271,407.)

2,457. "Inductance coil holders." Lissen, Ltd., and R. P. Richardson. January 27th, 1927. (281,895.)

4,414. "Incandescent cathode rectifiers." F. Meyer, H. J. Spanner, and C. Von Wedel. August 4th, 1926. (Addition to 274,026.) (275,550.)

6,210. "Electromagnetically-operated switches." R. Bosch Akt.-Ges. March 13th, 1926. (267,502.)

6,485. "Starting device for magnetos of internal combustion engines." A. Woosnam (Oy Svomen Magneto). March 8th, 1927. (281,909.)

7,756. "Electromagnetic devices for the interconversion of electrical and mechanical oscillations." British Thomson-Houston Co., Ltd. April 1st, 1926. (268,759.)

10,331. "Electric circuit breakers or contactors." F. Whipp and Whipp and Bourne, Ltd. April 14th, 1927. (281,926.)

11,593. "Junction boxes for high-tension electric cables." Naamlooze Vennootschap Nederlandsche Kabel-Fabriek. February 7th, 1927. (281,932.)

11,680. "Cores for electric transformers." International General Electric Co., Inc. May 18th, 1926. (Addition to 269,894.) (271,434.)

11,796. "Cores of electric transformers." International General Electric Co., Inc. May 20th, 1926. (Addition to 269,894.) 271,439.)

13,494. "Electric metering relay or like devices." British Thomson-Houston Co., Ltd., and R. D. Parry. May 19th, 1927. (281,943.)

14,356. "Circuit-controlling devices." L. Mellersh-Jackson (M. H. Shoenberg). May 27th, 1927. (281,947.)

14,964. "Ceiling lights." F. R. Lindley and L. H. M. Engineering Co., Ltd. June 7th, 1927. (281,954.)

15,498. "Talking motion pictures." W. E. Beatty (Bell Telephone Laboratories, Inc.). June 10th, 1927. (281,959.)

17,751. "Thermionic valves or electron discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 5th, 1926. (280,164.)

18,376 "Wave collectors or antennæ for radio-telegraphic and telephonic signals." M. Guillaix. July 9th, 1926. (274,119.)

18,971. "Sparking plug for internal-combustion engines." H. G. C. Fairweather (Soc. Anon. Nikon). July 18th, 1927. (Convention date not granted.) (274,503.)

19,491. "Electric switches." V. A. Trier. July 22nd, 1927. (Addition to 280,325.) (281,971.)

19,533. "Telephone sub station circuits and apparatus." R. L. J. L. De La Ville Le Roulx. July 22nd, 1926. (274,868.)

19,631. "Wireless distance-finding apparatus." C. A. Stevenson and D. A. Stevenson. June 2nd, 1927. (281,972.)

20,698. "Mercury-vapour rectifiers." Akt.-Ges. Brown, Boveri et Cie. August 28th, 1926. (276,650.)

21,013. "Starting of single-phase and polyphase electric motors by means of auto-transformers. Ateliers de Constructions Electriques de Charleroi. January 14th, 1927. (281,974.)

22,623. "Lock and protector for electric lamps." H. E. Ashdown. August 29th, 1927. (281,977.)

22,768. "Electric current rectifiers." Etablissements de Man Soc. Anon. February 23rd, 1927. (281,978.)

28,457. "Electrical remote-control and signalling systems." Siemens Bros. and Co., Ltd., and H. E. Humphries. June 8th, 1926. (Divided application on 280,254.) (281,987.)

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Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 28th :—

Orallion (lettering and design), No. 484,089, and Orallion (lettering and triangular design), No. 484,145. Class 8. Radio-telephonic and telegraphic receiving apparatus, but not including thermionic valves, &c.—Houghton-Butcher (Great Britain), Ltd., 88-89, High Holborn, W.C.1.

Stadion (lettering and design). No. 484,382. Class 8. Electric batteries (not for medical purposes).—J. Fabian, 35, Edgware Road, W.2.

Ascottia. No. 482,384. Class 18. Electric and gas cooking stoves, &c.—Cookers and Geysers, Ltd., 244, High Holborn, W.C.1.

CORRECTION.—In our last issue Trade Mark No. 485,837 (Saxonia Electric Wire Co., Ltd.) was incorrectly given as "Touchbestos," instead of "Toughbestos."

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Greyhound racing track (electric lighting); T. Scott Sutherland, architect.

AYRSHIRE.—Clinic at Ayr (£2,970). Annexe to Beith Academy (£12,850). Extension to Annbank School (£9,920). Extension to Doune Public School, Girvan (£4,120); clerk, Education Authority, Ayr.

BARNSLEY.—Greyhound racing track, for Barnsley Greyhounds, Ltd.; Henry Oxley, secretary, 22, Regent Street.

BIRKENHEAD.—Super cinema, Bidston Avenue and Norman Street, for Avenue Super Cinema, Ltd., 8, Hamilton Square.

BOLTON.—Additions, workshops, Nine House Lane; Angle Bank Welding Co.

BOURNEMOUTH.—Greyhound racing track, Branksome estate (£70,000), for a syndicate; particulars from Hankinson & Son, The Square.

BREDBURY AND ROMILEY.—Additional housing scheme (84), for the U.D.C.; surveyor.

BRIGHOUSE.—Secondary and technical school, for West Riding E.C.; Director of Education, Wakefield.

BROUGHTON.—School, for Northants. E.C.; Director of Education, Northampton.

BROWNHILLS.—Intermediate school, for Staffs. E.C.; Director of Education, Stafford.

BURNLEY.—Council and grammar schools and extension of central school; Education Committee.

CANNOCK.—Mining college (£25,000), for Staffs. E.C.; Major Lowbridge, education architect, Stafford.

CASTLE DOUGLAS.—Police station, &c. (£3,000); police superintendent.

CHELMSFORD.—56 houses, Tennyson Road; borough engineer.

CHORLEY.—30 houses, Letchworth Drive; J. W. Lee, Ltd. 50 houses, Marlborough estate; borough engineer.

DARLINGTON.—Senior school, South Park; infants' school, Dodmire; and open-air school, Harrowgate Hill; Director of Education

DULVERTON.—Extensions to Honey Mead, Exmoor, and new stables, for Sir R. Cohen.

DUMBARTON.—Conversion of manse into clinic (violet ray treatment); convener, Public Health Committee.

DUNDEE.—Commercial college (£40,000); principal, University College.

EAST PRESTON (SUSSEX).—Electric lighting installation; church school managers.

EDINBURGH.—School at Saughtonhall Mains. Preparatory school, for Royal High School. School at Prestonfield; clerk, Education Authority. 26 houses and six shops, for Corporation; city architect. Pier at Portobello, with concert hall, &c. (£100,000); city architect.

GLASGOW.—85 houses, Jordanhill; J. Downs. Buildings, Glasgow Cross (£50,000); city engineer.

HIGH WYCOMBE.—Chair factory, Lily's Walk, for Smith Bros. & Co. Factory extensions; G. A. Large & Son, Jubilee Road; T. W. Mealing and W. Birch, Ltd., Leigh Street.

HUDDERSFIELD.—Additional housing scheme (200), for the T.C.; borough surveyor.

IRISH FREE STATE (PEMBROKE, DUBLIN).—183 houses, for the U.D.C.; T. F. MacNamara, architect, 5, Dawson Street, Dublin.

(SKIBBEREEN, Co. CORK).—Electric lighting at the new hospital, for the West Cork Board of Public Assistance; J. J. Crowley, architect, County Home, Clonakilty.

KILMARNOCK.—Halls, for Martyrs' U.F. Church; the minister.

LEEDS.—University mining department, Woodhouse Lane: Lanchester, Lucas & Lodge, architects, 19, Bedford Square, London, W.C.1.

LEICESTER.—Three schools, Braunstone estate; Leicestershire Education Committee.

LONDON (ILFORD, E.).—120 houses, Tomshill estate; borough engineer. Extensions, Ship Carbon Co.'s factory, Grove Road; J. T. Luton & Son. Central school, Ley Street; Education Committee.

(POPLAR, E.).—Hall, Usher Street; J. Smith & Sons. 108 cottages, Millwall; borough engineer.

(EDMONTON, N.).—Housing scheme, Moat House estate, with electrical work; Major H. Jellicorse, Densworth, Chichester.

(HORNSEY, N.).—Flats, site of 69-76, Church Crescent; Rookfield Garden Village, Ltd.

LONDON—*contd.*

(BLACKHEATH, S.E.).—Wesleyan church at Burnt Ash (£5,000); trustees.

(LEWISHAM, S.E.).—Houses (192) and 32 flats, for the T.C.; David Weston & Co., Ltd., builders, Blackfriars House, New Bridge Street, E.C.

(SOUTHWARK, S.E.).—Tenements, Hankey Place; Church Army Housing, Ltd. Building scheme, Greenmoor Wharf and 45-46, Bankside; C. S. Peach. Improvements, Borough Market; market trustees. Buildings, 39-41, Newington Butts; Whinney, Sons & Austin Hall.

(EALING, W.).—36 houses and 80 flats, Framfield housing estate, for the T.C.; G. Ball (Willesden), Ltd. 149 houses, for Clark & Mitchell; H. S. Bostock, architect, Broadway Chambers, Southall.

MANSFIELD.—War memorial pavilion at Grammar School; Cook, Howard & Lane, architects.

MERTHYR.—Reconstruction, joint asylum (£250,000); Merthyr and Swansea Corporations.

MORECAMBE.—Development, Happy Mount extension; borough engineer.

MUSSELBURGH.—Wire rope factory, for Messrs. Brunton, Musselburgh Wire Mills (£10,000) (electrically driven); the manager.

NORTHAMPTON.—28 houses, Baring Road; borough engineer.

OLDHAM.—Greyhound racing track; J. F. Jones, Manchester.

PENISTONE.—Grammar school (£9,800), for the governors; clerk.

PETERBOROUGH.—Printing works, for William Pentney, Narrow Street.

PORTOBELLO.—Concert hall; A. Letta.

PRESTON.—Rewiring of Guildhall for electric lighting; borough electrical engineer.

PURLEY.—18 shops, Brighton Road; R. D. Taylor.

RAMSGATE.—Roman Catholic schools, for the managers; correspondent.

REDCAR.—Church and presbytery, for the Roman Catholic Church; priest-in-charge.

ST. ALBANS.—Re-erection of portion of the Regent Picture Palace, London Road; manager.

SMETHWICK.—Alterations, Majestic Picture House, Bearwood Road; E. Hewitson. Workshop, Ballot Street; Idoson Motor Cylinder Co. 135 houses, Old Chapel estate; borough engineer. 90 houses, off Pilling Lane; C. W. Norris.

SOUTHEND-ON-SEA.—Housing scheme (106) and flats, Eastwood Lane, for the T.C.; borough surveyor.

STIRLING.—Extensions at Golden Lion Hotel (electric lighting, electric lifts, heating, &c.); B. Reynolds & Son, builders.

STOCKPORT.—Battery house and garages, for the T.C.; H. Hamer, borough surveyor.

STOKE EDITH (HEREFORD).—Re-erection of mansion, for Paul Henry Foley.

SUTTON-IN-ASHFIELD.—Housing scheme (66), Alfreton Road; Warner, Bocock & Dean, architects, Mansfield Road.

SWANSEA.—Bank, Wind Street; Westminster Bank, Ltd. Cinema, Carmarthen Road and Station Road; A. J. Marles.

TILBURY.—Electric lighting, St. Chad's Road school; Essex Education Committee.

TUNBRIDGE WELLS.—Bank, National Provincial Bank, Ltd.; Ringmer Building Co., contractors, Ringmer. Bank, Pantiles; Barclay's Bank, Ltd.

UPPER DICKER (HAILSHAM).—Re-erection of Michelham Priory, for R. B. Wright.

WALLINGTON.—Factory, Hackbridge; Mullard Radio Valve Co., Ltd. Houses (74), for the U.D.C.; C. J. Doyle, builder, Victoria Street, Liverpool.

WARE.—Re-erection (after fire), of Standon Lordship (mansion), for Harold Swann.

WARSOP (NOTTS.).—Cinema, Church Street; Warsop Theatre Co., Ltd.

WELLINGBOROUGH.—Business premises, Midland Road, for Summers & Sons, Ltd. (£5,000).

WEST BROMWICH.—Council school, Charlemont; H. T. Buckland, architect.

WILLENHALL.—Housing scheme (120), Albion Road site; G. A. Waite, A.M.I.C.E., Town Hall.

WOMBWELL.—Blocks of shops, housing estate, for the U.D.C.; surveyor.

YEOVIL.—Additional 60 houses, for the R.D.C.; surveyor.

YORK.—Two blocks of houses, Hope Street area; city engineer.